

APPENDIX F

Water Quality Hydrology

Salton Sea Accounting Model

SALTON SEA ACCOUNTING MODEL

DRAFT

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**U.S. Bureau of Reclamation
Lower Colorado Region**

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1.0—Introduction

Assessment of the future of the Salton Sea (Sea) is dependent on the ability to predict the hydrologic response of the Sea to changing conditions. Foreseeable changes include a range of water conservation programs within the Salton Basin as well as possible restoration activities. The term “restoration” is used here to describe salinity reduction and control projects that might be developed. Conservation programs would likely change inflows of both water and dissolved solids into the Sea. Predicting hydrologic response to these possible changes requires a predictive computer model of the Salton Sea. The Salton Sea Accounting Model (Model) was developed for this purpose. This model is described in this document. A major aspect of the Model is the data contained within it. Therefore, salt and water budgets are also presented. Budgets are provided for historic and present level development conditions. In addition, forecasts of future changes in salt and water budgets are presented.

The development of the Salton Sea Accounting Model was a joint effort of the Bureau of Reclamation (Reclamation), Imperial Irrigation District (IID), and Coachella Valley water District (CVWD). The districts developed the historic and present level water budgets as well as future projections. Reclamation developed the model application.

2.0—Historic Inflows and Salt Loads

There are eight major sources of inflow to the Salton Sea. Table 2.1 lists each inflow source as well as the agency responsible for developing historic data attributed to each source.

**Table 2.1
Salton Sea
Historic Water and Salt Budget
Inflow Sources and Agencies Contributing Data**

Inflow Source	Contributing Agency
Mexico discharges into the New River	IID
Mexico discharges into the Alamo River	IID
IID discharges into the New River	IID
IID discharges into the Alamo River	IID
IID discharges direct to the Sea	IID
CVWD surface discharges	CVWD
Coachella aquifer discharges	CVWD
Unmeasured inflows	Reclamation

Details about developing each component, except the unmeasured inflows, are not provided here. Inquiries about details of the other components should be directed to either IID or CVWD. The development of the unmeasured inflows is discussed later in this document in discussions of Model calibration and net evaporation.

2.1 – Historic Water Budget

Table 2.2 presents a compilation of historic water inflow records for budget components listed in Table 2.1. This compilation represents a comprehensive historic water budget to the Salton Sea. This budget was used in the calibration and verification of the Model which is described later in this document. Figure 2.1 depicts each of the historic water budget components in hydrograph format. In the early 1980s, inflows from CVWD began declining. During this same period, inflows from Mexico increased.

2.2 – Historic Salt Budget

Table 2.3 presents a compilation of historic salt load records for budget components listed in Table 2.1. This compilation represents a comprehensive historic salt budget to the Salton Sea. Estimates of salt dissolved as the Sea inundated new areas (from 1950) is also provided in Table 2.3. These estimates assume that a half inch of salt was contained in the top layer of newly inundated sediments and that the salts were dissolved completely within each year. Exact estimates of salts dissolved as the Sea inundated new areas is not possible. However, not taking this into consideration in some fashion would have made the historic salt budget incomplete. This budget was used in the verification of the Model which is described later in this document. Figure 2.2 shows the salt budget in hydrograph form. In the early 1980s, salt loads from both IID and CVWD decreased. Loadings from Mexico increased substantially during the 1980s.

Table 2.2
Salton Sea
Historic Water Budget

Col. 1	Col.. 2 Col. 3+4	Col. 3	Col. 4	Col. 5 Col. 6+7	Col. 6	Col. 7	Col. 8	Col. 9 Col. 4+7+8	Col. 10 Col.3+6	Col. 11 Historic ^{2/}	Col. 12	Col. 13 Col 11+12	Col. 14`	Col. 15	Col. 16 Col 14+15	
		Historic ^{1/}	Total ^{1/}	Total ^{1/}	Historic ^{2/}	Surface	Historic ^{2/}	Total ^{2/}	Historic ^{2/}	Total ^{3/}	Total ^{3/}					
Year		Alamo R.	Inflow	Alamo R.	Inflow	New R.	Inflow	New R.	Inflow	Mexico	Flows	Aquifer	Total ^{2/}	Historic ^{2/}	Unmeasured	Total ^{Historic}
1950	606862	1393	605469	460665	36992	423673	75658	1104800	38385	65811	2710	68521	1211706	68400	1280106	
1951	642031	1385	640646	489668	35508	454160	74621	1169427	36893	108765	2632	111397	1317717	68400	1386117	
1952	697247	1250	695997	524461	35917	488544	76032	1260573	37167	87139	2341	89480	1387220	68400	1455620	
1953	756663	1308	755355	540547	31116	509431	81212	1345998	32424	62607	2396	65003	1443425	68400	1511825	
1954	732821	1431	731390	492737	29505	463232	78588	1273210	30936	72467	2064	74531	1378677	68400	1447077	
1955	654455	1915	652540	395860	46985	348875	68394	1069809	48900	85367	2016	87383	1206092	68400	1274492	
1956	684155	2042	682113	429655	42713	386942	52333	1121388	44755	70602	2067	72669	1238812	68400	1307212	
1957	622850	1762	621088	402516	70845	331671	58620	1011379	72607	53368	2205	55573	1139559	68400	1207959	
1958	614481	1991	612490	405194	103983	301211	60344	974045	105974	56358	2243	58601	1138620	68400	1207020	
1959	651750	1819	649931	434219	121824	312395	58637	1020963	123643	57105	2345	59450	1204056	68400	1272456	
1960	682450	1921	680529	445059	121312	323747	55528	1059804	123233	70431	2336	72767	1255804	68400	1324204	
1961	675576	1795	673781	436967	115031	321936	54983	1050700	116826	83894	2290	86184	1253710	68400	1322110	
1962	681100	1705	679395	455330	132179	323151	86419	1088965	133884	112692	2241	114933	1337782	68400	1406182	
1963	723765	2158	721607	477479	138936	338543	93647	1153797	141094	133333	2062	135395	1430286	68400	1498686	
1964	563557	1834	561723	365857	105087	260770	82660	905153	106921	123248	1991	125239	1137313	68400	1205713	
1965	535096	1798	533298	357747	111339	246408	103256	882962	113137	138788	2172	140960	1137059	68400	1205459	
1966	610745	1545	609200	383469	102958	280511	114974	1004685	104503	128071	2220	130291	1239479	68400	1307879	
1967	621091	1556	619535	383211	96899	286312	122123	1027970	98455	133784	2244	136028	1262453	68400	1330853	
1968	611089	1469	609620	384078	106019	278059	113348	1001027	107488	133097	2262	135359	1243874	68400	1312274	
1969	592664	1595	591069	375449	103312	272137	99433	962639	104907	130583	2319	132902	1200448	68400	1268848	
1970	619018	1645	617373	390487	99671	290816	112314	1020503	101316	131253	2390	133643	1255462	68400	1323862	
1971	671770	1510	670260	422995	107281	315714	106597	1092571	108791	142977	2403	145380	1346742	68400	1415142	
1972	638743	1435	637308	418063	111165	306898	119331	1063537	112600	155126	2387	157513	1333650	68400	1402050	
1973	638902	1370	637532	428639	117160	311479	116403	1065414	118530	163211	2372	165583	1349527	68400	1417927	
1974	682320	1227	681093	436575	111839	324736	117663	1123492	113066	157208	2342	159550	1396108	68400	1464508	
1975	682345	1568	680777	434507	99791	334716	112775	1128268	101359	173502	2229	175731	1405358	68400	1473758	
1976	638917	1071	637846	435111	102588	332523	114924	1085293	103659	174684	2002	176686	1365638	68400	1434038	
1977	615009	1419	613590	412978	107713	305265	101942	1020797	109132	156787	1784	158571	1288500	68400	1356900	

Col. 1	Col.. 2 Col. 3+4	Col. 3	Col. 4	Col. 5 Col. 6+7	Col. 6	Col. 7	Col. 8	Col. 9 Col. 4+7+8	Col. 10 Col.3+6	Col. 11 Historic ^{2/} Total ^{1/}	Col. 12	Col. 13 Col 11+12	Col. 14 ⁺	Col. 15	Col. 16 Col 14+15
Year	(af)	(af)	(af)	(af)	(af)	(af)	(af)	(af)	(af)	Surface Flows Mexico to Sea frm CVWD	Historic ^{2/} Aquifer Flows to Sea frm CVWD	Total ^{2/} Historic Reported Inflow	Total Historic Unmeasured Inflow	Total Historic Inflow	
1978	603073	1296	601777	393045	98408	294637	99260	995674	99704	144098	1727	145825	1241203	68400	1309603
1979	635126	1416	633710	457720	144905	312815	110127	1056652	146321	151002	1595	152597	1355570	68400	1423970
1980	641581	1655	639926	454544	156320	298224	105091	1043241	157975	143958	1453	145411	1346627	68400	1415027
1981	591591	2274	589317	433241	155443	277798	95810	962925	157717	156788	1402	158190	1278832	68400	1347232
1982	543453	1990	541463	416302	157009	259293	87919	888675	158999	152282	1415	153697	1201371	68400	1269771
1983	551971	1909	550062	477433	242606	234827	82946	867835	244515	150956	1186	152142	1264492	68400	1332892
1984	563917	1831	562086	512260	267904	244356	88592	895034	269735	140985	1053	142038	1306807	68400	1375207
1985	509547	1867	507680	489532	260238	229294	93867	830841	262105	123855	983	124838	1217784	68400	1286184
1986	498992	1890	497102	512348	264837	247511	89354	833967	266727	122959	836	123795	1224489	68400	1292889
1987	512200	2058	510142	493152	250862	242290	99262	851694	252920	117032	757	117789	1222403	68400	1290803
1988	558687	2152	556535	488940	226802	262138	100053	918726	228954	117188	603	117791	1265471	68400	1333871
1989	593664	1883	591781	431428	153439	277989	96109	965879	155322	110816	572	111388	1232589	68400	1300989
1990	617866	1993	615873	430510	133088	297422	91088	1004383	135081	109613	526	110139	1249603	68400	1318003
1991	594126	1951	592175	410629	130775	279854	88341	960370	132726	103866	415	104281	1197377	68400	1265777
1992	546043	1709	544334	396595	143178	253417	80734	878485	144887	100817	255	101072	1124444	68400	1192844
1993	617025	1642	615383	460296	190457	269839	88589	973811	192099	93504.76	169	93674	1259584	68400	1327984
1994	641071	1744	639327	443064	145260	297804	108805	1045936	147004	100277.45	51	100328	1293268	68400	1361668
1995	646167	1223	644944	472686	148762	323924	115134	1084002	149985	98062.57	-149	97913	1331900	68400	1400300
1996	640974	1077	639897	436589	118678	317911	118746	1076554	119755	94146.55	-197	93949	1290258	68400	1358658
1997	636810	1653	635157	487223	160762	326461	107093	1068711	162415	90685.64	-108	90578	1321704	68400	1390104
1998	649120	1446	647674	490930	174870	316060	108387	1072121	176316	85722.84	-287	85435	1333872	68400	1402272
1999	643426	1668	641758	465779	176447	289332	94414	1025504	178115	81765.22	-366	81400	1285019	68400	1353419
Average	623678	1665	622013	441475	128934	312541	93250	1027804	130599	115053	1539	116592	1274995	68400	1343395

1/ Provided by Imperial Irrigation District

2/ Provided by Coachella Valley Water District

3/ Computed during Model Calibration

Table 2.3
Salton Sea
Historic Salt Budget

Year	Total ^{1/} Historic IID Salt Load to Sea (tons/yr)	Total ^{1/} Historic Mexico Salt Load to Sea (tons/yr)	Historic Salt Dissolved As Sea Inundated New Areas (tons/yr)	Historic ^{2/} Surface Flow Salt Load to Sea frm CVWD (tons/yr)	Historic ^{2/} Aquifer Salt Load frm CVWD (tons/yr)	Total Salt Load frm CVWD (tons/yr)	Total Historic Salt Load (tons/yr)
1950	2855378	84823	0	62200	7600	69800	3010001
1951	3139970	92572	416234	107100	7300	114400	3763176
1952	3364335	75842	584085	80900	6400	87300	4111562
1953	3684315	74128	717842	63800	5800	69600	4545885
1954	3648649	84301	528700	95100	4600	99700	4361350
1955	3577562	244785	419165	142000	2200	144200	4385712
1956	3713208	436841	159520	148100	1500	149600	4459169
1957	3603489	389519	0	141300	1500	142800	4135808
1958	3341376	530475	0	136900	2000	138900	4010751
1959	3401652	569705	0	145600	2000	147600	4118957
1960	3558534	603009	40266	190600	2200	192800	4394609
1961	3572808	576148	238972	237100	1300	238400	4626328
1962	3806946	612071	120026	328200	100	328300	4867343
1963	4050087	639664	372266	364200	-1500	362700	5424717
1964	3635121	678175	772455	355600	-4700	350900	5436651
1965	3819255	786501	0	418900	-6400	412500	5018256
1966	4148874	704090	0	386500	-3800	382700	5235664
1967	4139477	635787	0	374700	-3900	370800	5146064
1968	4012009	740074	0	372700	-4100	368600	5120683
1969	3754477	733842	0	362200	-4300	357900	4846219
1970	3780732	630950	0	369500	-4000	365500	4777182
1971	3900990	635685	0	397200	-3500	393700	4930375
1972	3876592	684430	0	421700	-3900	417800	4978822
1973	3980338	693063	0	437100	-4800	432300	5105701
1974	4204158	664649	0	444400	-5700	438700	5307507
1975	4196407	618895	211357	474600	-7000	467600	5494259
1976	4361658	669954	264736	486400	-10200	476200	5772548
1977	4187227	681825	780323	442000	-14500	427500	6076875
1978	3824323	684077	135762	419000	-18000	401000	5045162
1979	3998131	830984	0	421900	-19300	402600	5231715
1980	3988611	886112	270290	391700	-21400	370300	5515313
1981	3825050	983071	270598	453400	-24600	428800	5507519
1982	3608490	951238	0	454000	-25200	428800	4988528
1983	3333260	1269999	0	407500	-24300	383200	4986459
1984	3360246	1245141	0	360400	-28700	331700	4937087
1985	3296231	1094768	0	300600	-30700	269900	4660899
1986	2837518	1156095	0	291500	-30900	260600	4254213
1987	2753625	902813	0	282900	-32600	250300	3906738
1988	2854307	867612	0	281100	-32500	248600	3970519
1989	3139003	558769	0	271900	-34400	237500	3935272

Year	Total ^{1/} Historic IID Salt Load to Sea (tons/yr)	Total ^{1/} Historic Mexico Salt Load to Sea (tons/yr)	Historic Salt Dissolved As Sea Inundated New Areas (tons/yr)	Historic ^{2/} Surface Flow Salt Load to Sea frm CVWD (tons/yr)	Historic ^{2/} Aquifer Salt Load frm CVWD (tons/yr)	Total Salt Load frm CVWD (tons/yr)	Total Historic Salt Load (tons/yr)
1990	3328850	516591	0	273800	-33700	240100	4085541
1991	3033473	533884	0	263500	-33700	229800	3797157
1992	3247280	574283	0	248300	-35500	212800	4034363
1993	3476144	585887	0	225000	-39600	185400	4247431
1994	3371582	529953	0	196400	-41000	155400	4056935
1995	3293672	528697	0	174300	-45100	129200	3951569
1996	3445080	456753	32999	177800	-53700	124100	4058932
1997	3444677	643617	0	177300	-54700	122600	4210894
1998	3229808	601958	0	186900	-63900	123000	3954766
1999	3066967	594727	0	179200	-68900	110300	3771994
Average	3581439	631376	126711	288500	-16604	271896	4611423

1/ Provided by Imperial Irrigation
District

2/ Provided by Coachella Valley Water District

Figure 2.1
Salton Sea
Historic Inflows

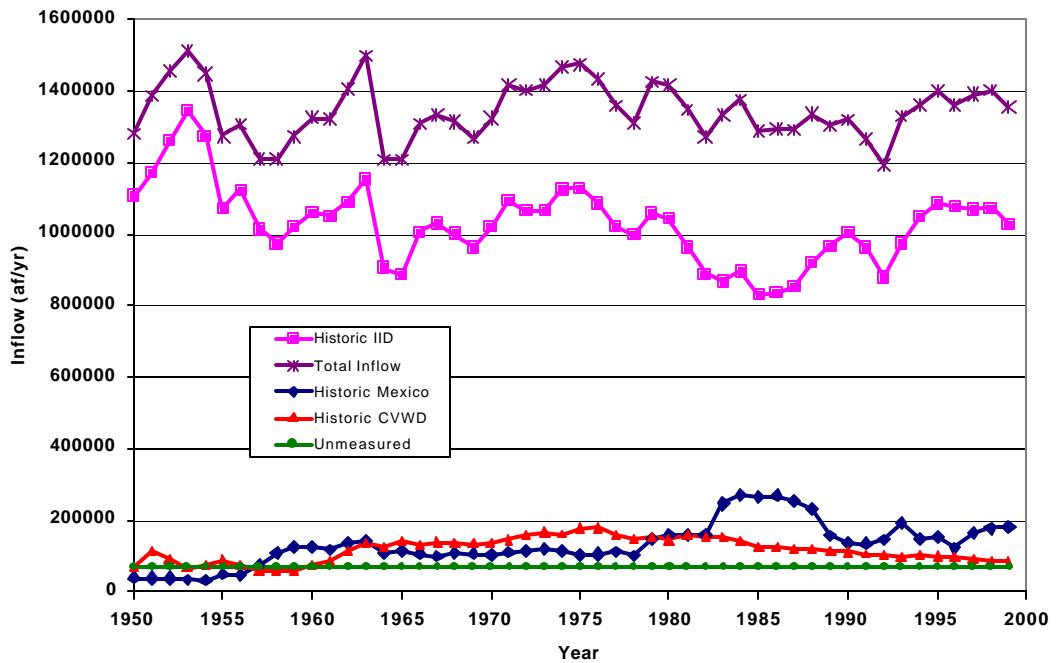
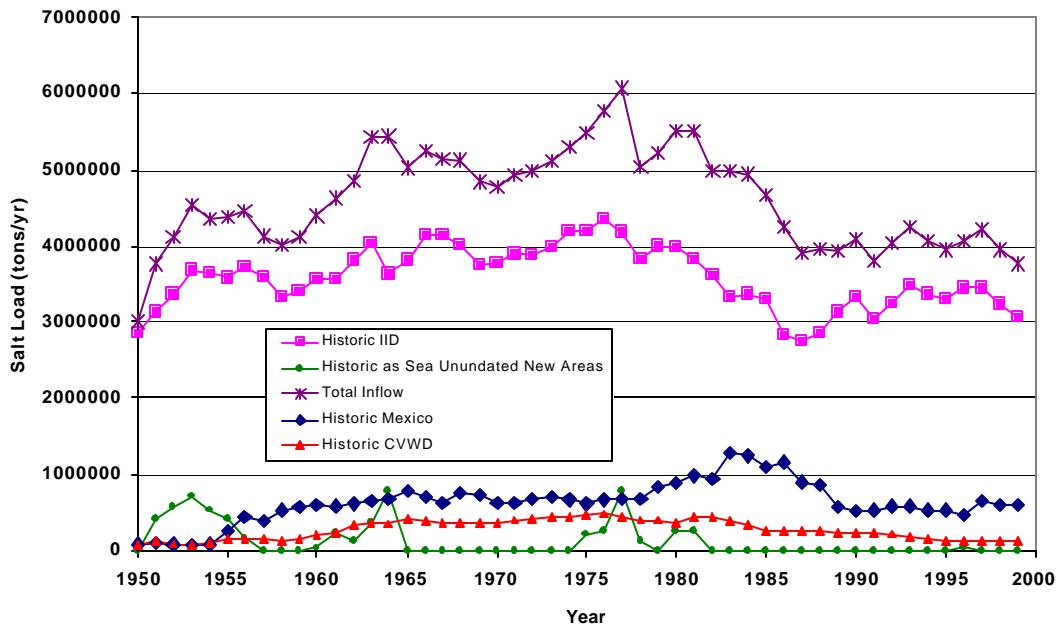


Figure 2.2
Salton Sea
Historic Salt Load



3.0 — Historic Net Evaporation

3.1- Historic Pan Data

Using historic pan evaporation data in developing a computer model is a major source of errors and uncertainty. Problems associated with such data are, for the most part, due to measurement error. Such errors can be due to poor maintenance of water levels, bird/animal water consumption and bathing, stage recorder, and/or manual measurement errors. The result is that very little correlation exists between pan stations located even relatively close together. An assessment was performed of pan evaporation data from multiple stations maintained and operated by IID around the Salton Sea. Data from these surrounding stations were observed to have no correlation to each other, bringing into question the application of such data in predicting historic evaporation from the Salton Sea. As a result, pan evaporation data were not used in the development of the Model.

3.2 - Historic Precipitation Data

Historic precipitation data can also be a major source of error and uncertainty in developing a computer model. Problems associated with such data can be attributable to spatial variability in the tracking storms across a basin and stage recorder and/or manual measurement errors. Spatial variability problems make it impossible to assume that precipitation over a large body of water, such as the Salton Sea, can be represented by a few rain gauges located nearby. Point measurements of precipitation data cannot be used to represent rainfall over a large surface area. As a result, historic precipitation records from nearby climate stations were not used.

3.2 - Net Term Evaporation

To minimize errors in the Model from estimating evaporation and precipitation on the Salton Sea a unique approach was taken. The use of a “net term evaporation” was applied. This net term was computed during the calibration of the Model such that net term evaporation (being defined as Sea evaporation less Sea precipitation) was back calculated as a resultant term in the process of developing the historic water budget presented in Table 2.2. This was accomplished by simultaneously solving for average annual unmeasured inflows and net term evaporation. An iterative technique was applied such that unmeasured inflows were adjusted until a back calculated net term evaporation term equaled 68 inches on an average annual basis. A value of 68 inches for evaporation was derived as a target from a previous study of Salton Sea evaporation (Hughes 1967) and estimates of average annual precipitation in the Salton Basin. The USGS estimated evaporation from the Salton Sea to be 70.5 inches using a water budget approach. Average annual precipitation over the basin was estimated at 2.5 inches. Subtracting this

average annual precipitation value from the 70.5 inches of evaporation resulted in a target of 68 inches for net evaporation. Table 3.1 presents a listing of the net evaporation computed in this process. This data is the basis for net evaporation calculations within the Model.

Table 3.1
Calculated Salton Sea Net Term Evaporation

Year	Net Term Evaporation (inches)
1950	67.6
1951	67.9
1952	66.6
1953	74.2
1954	69.4
1955	66.2
1956	73.9
1957	66.0
1958	67.1
1959	68.3
1960	66.0
1961	69.1
1962	67.2
1963	63.8
1964	71.6
1965	67.2
1966	69.2
1967	69.1
1968	70.3
1969	68.0
1970	71.0
1971	71.6
1972	71.8
1973	70.4
1974	73.7
1975	71.3
1976	56.1
1977	65.6
1978	66.7
1979	66.3
1980	64.2
1981	70.2
1982	66.4
1983	56.1
1984	69.9

Year	Net Term Evaporation (inches)
1985	67.8
1986	69.2
1987	68.0
1988	70.3
1989	72.3
1990	71.0
1991	64.7
1992	62.1
1993	60.5
1994	68.0
1995	68.6
1996	77.4
1997	72.0
1998	71.4
1999	72.5
Average	68.0

4.0 — Present Level Inflows and Salt Loads

Using historic water and salt budget data in the simulation of the Model to predict the future under existing conditions is not possible. The development of present level inflow budgets for both water and salt were required. There are eight major sources of future inflow to the Salton Sea. Table 2.1 lists each inflow source as well as the agency responsible for developing historic water and salt load inflows. This table also applies to the development of present level data attributed to each source. Present level inflows were provided by IID and CVWD based on their respective modeling efforts. Therefore, details about the development of present level flow components are not provided here. In summary these inflows represent effects due to a pre-existing conservation program between IID and MWD, effects of priority 3 entitlement enforcement of Colorado River water, the need for increased leaching within IID due to forecasted increases in salinity at Imperial Dam, changes in water use patterns in CVWD, and changes in Coachella Aquifer interactions with the Salton Sea. Inquiries of the details behind these inflows should be directed to either IID or CVWD. Present level unmeasured inflows cannot be predicted and are assumed to be the same as historic.

4.1 – Present Level Water Budget

Table 4.1 presents a compilation of present level water inflow records for components listed in Table 2.1. This compilation represents a comprehensive present level water budget to the Salton Sea. The model has the ability to simulate future conditions based on the assumption that present level conditions will continue. This water budget can be used as a starting point from which future changes to the Sea can be measured. Figure 4.1 depicts hydrographs of each present level development inflow component. It is difficult to predict present level flows from Mexico and there are no known published studies of such. Therefore it was assumed that future flows from Mexico would be equal to historic average annual flows for the years 1989 to 1999 plus 3 percent for increased future salinity in the Colorado River. Data provided by CVWD indicates that inflows from CVWD will decrease through time as a result of aquifer over drafting.

4.2 – Present Level Salt Budget

Table 4.2 presents a compilation of present level salt inflow records for components listed in Table 2.1. This compilation represents a comprehensive present level salt budget to the Salton Sea. This salt budget does not include a component for dissolving materials on newly inundated since the Sea is not expected to rise in elevation under present level conditions. This salt budget can be used as a starting point from which future changes to the Sea can be measured. The model has the ability to simulate future conditions based on the assumption that present level conditions will continue. Figure 4.2 is a hydrograph of present level salt loads from all sources. Salt loads from CVWD will eventually become negative as the Coachella Aquifer water levels decline and the Salton Sea recharges the aquifer in the future. This recharge will be minor in degree and will not involve large quantities of water. Mexico values are constant due to the assumption they will not change and are equal to average annual historic values for the period 1989 to 1999.

Table 4.1
Salton Sea
Present Level Water Budget

Year	Mexico 4/ Baseline Inflow (af)	IID 1/ Baseline Discharge to Sea (af)	Baseline 2/		CVWD 2/ Baseline Flows to Sea (af)	Inflow 1/ Reduction Due to Entitlement Enforcement (af)	Total 3/ Unmeasured Inflow (af)	Total Baseline Inflow to Sea (af)
			Drain Flows/CVSC frm CVWD (af)	Baseline 2/ Aquifer Flows frm CVWD (af)				
2000	158592	952178	77534	-455	77080	-56856	68400	1199394
2001	158592	1053354	76222	-524	75698	-56856	68400	1299188
2002	158592	1019665	75836	-581	75255	-56856	68400	1265056
2003	158592	980000	75682	-633	75049	-56856	68400	1225185
2004	158592	949340	76429	-686	75743	-56856	68400	1195219
2005	158592	940522	76967	-742	76225	-56856	68400	1186883
2006	158592	934397	77174	-801	76373	-56856	68400	1180906
2007	158592	1027601	77176	-862	76315	-56856	68400	1274052
2008	158592	938780	76678	-928	75751	-56856	68400	1184667
2009	158592	976357	76220	-993	75227	-56856	68400	1221720
2010	158592	940652	75824	-1057	74767	-56856	68400	1185555
2011	158592	1096364	75437	-1119	74319	-56856	68400	1340819
2012	158592	1102122	75106	-1178	73928	-56856	68400	1346186
2013	158592	1035992	74774	-1236	73538	-56856	68400	1279666
2014	158592	1015039	74463	-1292	73171	-56856	68400	1258346
2015	158592	1057841	74172	-1345	72827	-56856	68400	1300804
2016	158592	958137	73958	-1396	72562	-56856	68400	1200835
2017	158592	1097408	73780	-1441	72338	-56856	68400	1339882
2018	158592	970489	73616	-1485	72131	-56856	68400	1212756
2019	158592	1102483	73448	-1529	71919	-56856	68400	1344538
2020	158592	933630	73291	-1569	71721	-56856	68400	1175487
2021	158592	1018457	73135	-1606	71529	-56856	68400	1260122
2022	158592	984430	72988	-1646	71342	-56856	68400	1225908
2023	158592	1105981	72834	-1686	71148	-56856	68400	1347265
2024	158592	1041634	72665	-1728	70937	-56856	68400	1282707
2025	158592	987664	72479	-1769	70710	-56856	68400	1228510
2026	158592	1009093	72319	-1812	70507	-56856	68400	1249736
2027	158592	1028147	72163	-1858	70305	-56856	68400	1268588
2028	158592	988991	72011	-1905	70106	-56856	68400	1229233
2029	158592	991076	71857	-1953	69904	-56856	68400	1231116
2030	158592	1106342	71709	-2000	69709	-56856	68400	1346187
2031	158592	997398	71562	-2048	69514	-56856	68400	1237048
2032	158592	947379	71414	-2097	69317	-56856	68400	1186832
2033	158592	1035849	71292	-2146	69146	-56856	68400	1275131
2034	158592	1029275	71184	-2196	68988	-56856	68400	1268399
2035	158592	945364	71059	-2246	68813	-56856	68400	1184313
2036	158592	1022577	70513	-2297	68215	-56856	68400	1260928
2037	158592	1021389	69968	-2349	67619	-56856	68400	1259144

Year	Mexico 4/ Baseline Inflow (af)	Baseline 2/			Inflow 1/			Total Baseline Inflow (af)
		IID 1/ Baseline Discharge to Sea (af)	Drain Flows/CVSC frm CVWD (af)	Baseline 2/ Aquifer Flows frm CVWD (af)	CVWD 2/ Baseline Discharge to Sea (af)	Reduction Due to Entitlement Enforcement (af)	Total 3/ Unmeasured Inflow (af)	
2038	158592	1091373	69427	-2401	67026	-56856	68400	1328535
2039	158592	1002077	68889	-2454	66435	-56856	68400	1238648
2040	158592	938756	68354	-2508	65846	-56856	68400	1174738
2041	158592	884449	67822	-2562	65261	-56856	68400	1119846
2042	158592	937873	67295	-2617	64678	-56856	68400	1172687
2043	158592	987754	66770	-2672	64099	-56856	68400	1221989
2044	158592	927646	66250	-2728	63523	-56856	68400	1161305
2045	158592	982748	65734	-2784	62950	-56856	68400	1215834
2046	158592	992067	65222	-2841	62381	-56856	68400	1224584
2047	158592	1005793	64715	-2899	61816	-56856	68400	1237745
2048	158592	1016584	64212	-2957	61255	-56856	68400	1247975
2049	158592	1022530	63713	-3016	60697	-56856	68400	1253363
2050	158592	879393	63219	-3075	60144	-56856	68400	1109673
2051	158592	944597	62730	-3135	59595	-56856	68400	1174328
2052	158592	1114332	62247	-3196	59051	-56856	68400	1343519
2053	158592	923277	61768	-3257	58511	-56856	68400	1151924
2054	158592	996533	61294	-3319	57975	-56856	68400	1224644
2055	158592	939315	60826	-3381	57445	-56856	68400	1166896
2056	158592	1017618	60362	-3444	56919	-56856	68400	1244673
2057	158592	942368	59905	-3507	56397	-56856	68400	1168901
2058	158592	946206	59453	-3572	55881	-56856	68400	1172223
2059	158592	918281	59006	-3636	55369	-56856	68400	1143786
2060	158592	1090278	58565	-3702	54863	-56856	68400	1315277
2061	158592	1018620	58130	-3768	54362	-56856	68400	1243118
2062	158592	886105	57700	-3835	53865	-56856	68400	1110106
2063	158592	936635	57276	-3902	53374	-56856	68400	1160145
2064	158592	971767	56858	-3970	52888	-56856	68400	1194791
2065	158592	984432	56446	-4039	52407	-56856	68400	1206975
2066	158592	937504	56040	-4108	51932	-56856	68400	1159572
2067	158592	850081	55639	-4178	51461	-56856	68400	1071678
2068	158592	942359	55245	-4249	50996	-56856	68400	1163491
2069	158592	983336	54857	-4321	50536	-56856	68400	1204008
2070	158592	1016119	54474	-4393	50081	-56856	68400	1236336
2071	158592	1084471	54098	-4466	49631	-56856	68400	1304238
2072	158592	1103947	53727	-4540	49187	-56856	68400	1323270
2073	158592	1094724	53362	-4615	48747	-56856	68400	1313607
2074	158592	1000653	53004	-4690	48313	-56856	68400	1219102
Average	158592	995413	67328	-2452	64875	-56856	68400	1230425

1/ Provided by Imperial Irrigation District

2/ Provided by Coachella Valley Water District

3/ No future change from historic is expected

4/ Average historic for years 1989 to 1999 plus 3 percent for increased salinity in Colorado River

Table 4.2
Salton Sea
Present Level Salt Budget

Year	Mexico 1/ Baseline Salt Load (tons/yr)	IID 1/ Baseline Salt Load (tons/yr)	CVWD 2/ Baseline Salt Load (tons/yr)	Reduction 1/ in Salt Due to Entitlement Enforcement (tons/yr)	Total Baseline Salt Load (tons/yr)
2000	556829	3322499	94401	-71052	3902677
2001	556829	3366696	87554	-71052	3940027
2002	556829	3396683	93703	-71052	3976163
2003	556829	3424603	90448	-71052	4000828
2004	556829	3323010	89370	-71052	3898157
2005	556829	3299450	77070	-71052	3862297
2006	556829	3227023	74420	-71052	3787220
2007	556829	3349659	71225	-71052	3906661
2008	556829	3288365	66743	-71052	3840885
2009	556829	3381829	72688	-71052	3940294
2010	556829	3232189	68575	-71052	3786541
2011	556829	3551068	64484	-71052	4101329
2012	556829	3576103	60719	-71052	4122599
2013	556829	3445681	57054	-71052	3988512
2014	556829	3264394	53636	-71052	3803807
2015	556829	3427082	50366	-71052	3963225
2016	556829	3248941	47372	-71052	3782090
2017	556829	3565121	34851	-71052	4085749
2018	556829	3331390	32395	-71052	3849562
2019	556829	3546706	30031	-71052	4062514
2020	556829	3301865	27889	-71052	3815531
2021	556829	3407048	25852	-71052	3918677
2022	556829	3445370	23734	-71052	3954881
2023	556829	3594752	21599	-71052	4102128
2024	556829	3458898	19331	-71052	3964006
2025	556829	3447560	17128	-71052	3950465
2026	556829	3434276	14780	-71052	3934833
2027	556829	3452860	2451	-71052	3941088
2028	556829	3440297	-157	-71052	3925917
2029	556829	3436980	-2671	-71052	3920086
2030	556829	3567579	-5172	-71052	4048184
2031	556829	3475968	-7671	-71052	3954074
2032	556829	3305266	-10373	-71052	3780670
2033	556829	3448445	-12921	-71052	3921301
2034	556829	3434391	-25098	-71052	3895070
2035	556829	3322073	-27734	-71052	3780116
2036	556829	3404727	-31173	-71052	3859331
2037	556829	3399918	-34707	-71052	3850988
2038	556829	3527938	-38235	-71052	3975480
2039	556829	3412273	-41757	-71052	3856293
2040	556829	3278980	-45373	-71052	3719384

	Mexico 1/ Baseline	IID 1/ Baseline	CVWD 2/ Baseline	Reduction 1/ in Salt Due to Entitlement Enforcement	Total Baseline Salt Load
Year	(tons/yr)	(tons/yr)	(tons/yr)	(tons/yr)	(tons/yr)
2041	556829	3215236	-48982	-71052	3652031
2042	556829	3226817	-52685	-71052	3659909
2043	556829	3381318	-56380	-71052	3810715
2044	556829	3242971	-60068	-71052	3668680
2045	556829	3384930	-63749	-71052	3806958
2046	556829	3372211	-76370	-71052	3781618
2047	556829	3370741	-80165	-71052	3776353
2048	556829	3412826	-83952	-71052	3814651
2049	556829	3408825	-87731	-71052	3806871
2050	556829	3195655	-91602	-71052	3589830
2051	556829	3213389	-95464	-71052	3603702
2052	556829	3488604	-99318	-71052	3875063
2053	556829	3263426	-103262	-71052	3645941
2054	556829	3374209	-107298	-71052	3752688
2055	556829	3245841	-111224	-71052	3620394
2056	556829	3402452	-115341	-71052	3772888
2057	556829	3231338	-127475	-71052	3589640
2058	556829	3224846	-131611	-71052	3579012
2059	556829	3223631	-135638	-71052	3573770
2060	556829	3518586	-139856	-71052	3864507
2061	556829	3432582	-143965	-71052	3774394
2062	556829	3236172	-148164	-71052	3573785
2063	556829	3314338	-152454	-71052	3647661
2064	556829	3405320	-156735	-71052	3734362
2065	556829	3395959	-168764	-71052	3712972
2066	556829	3246003	-173070	-71052	3558710
2067	556829	3050843	-177467	-71052	3359153
2068	556829	3183190	-181856	-71052	3487111
2069	556829	3315452	-186336	-71052	3614893
2070	556829	3373925	-190906	-71052	3668796
2071	556829	3535882	-195468	-71052	3826191
2072	556829	3540304	-200021	-71052	3826060
2073	556829	3558742	-211905	-71052	3832614
2074	556829	3469929	-216592	-71052	3739114
Average	556829	3373633	-42467	-71052	3816942

1/ Provided by Imperial Irrigation District

2/ Provided by Coachella Valley Water District

3/ Average historic for years 1989 to 1999

Figure 4.1
Salton Sea
Present Level Inflows

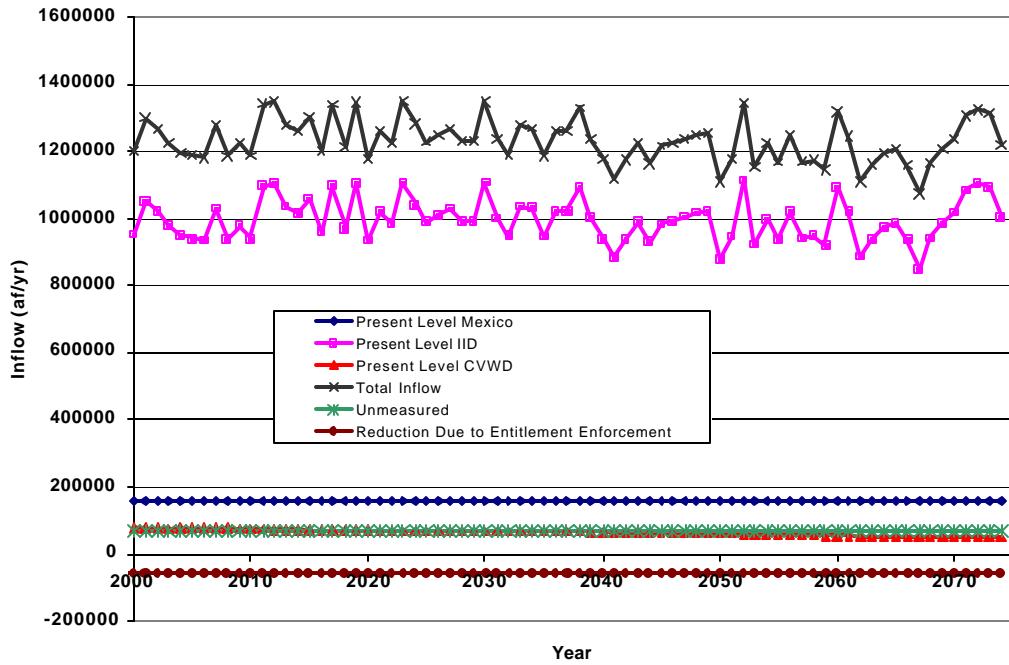
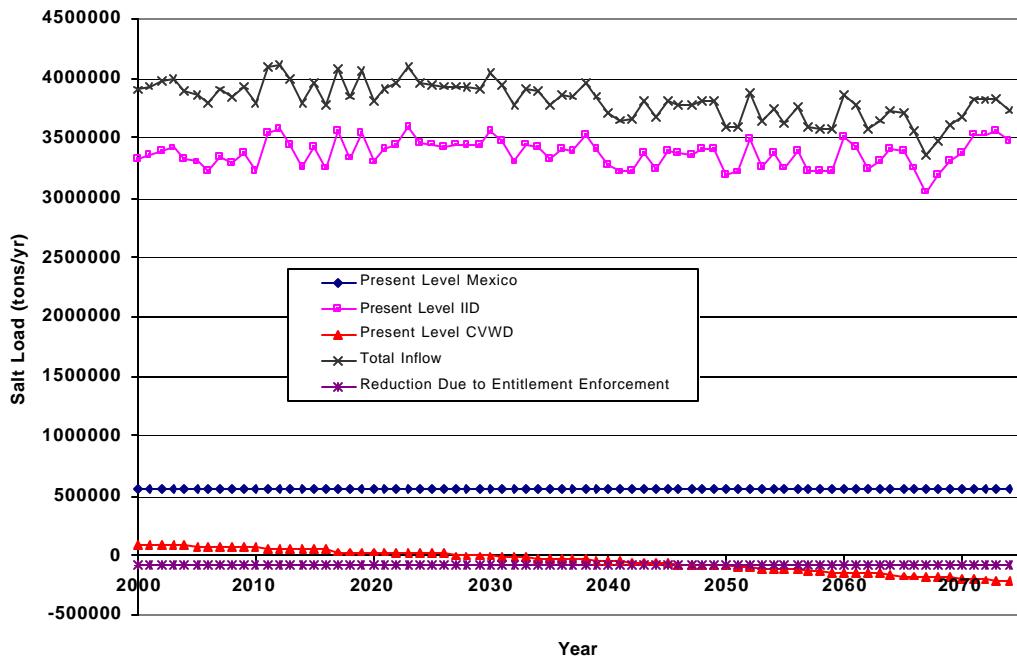


Figure 4.2
Salton Sea
Present Level Salt Load



5.0 — Salton Sea Accounting Model

5.1 — Overview

This model is a spreadsheet model that resides inside of Microsoft Excel 2000 and utilizes a risk and uncertainty package produced by Palisades called @Risk. The Salton Sea Accounting Model incorporates the ability to perform stochastic and deterministic simulations of Salton Sea conditions. These stochastic capabilities provide for analysis of the variability of hydrologic parameters such as Sea inflow. The model operates on an annual time step.

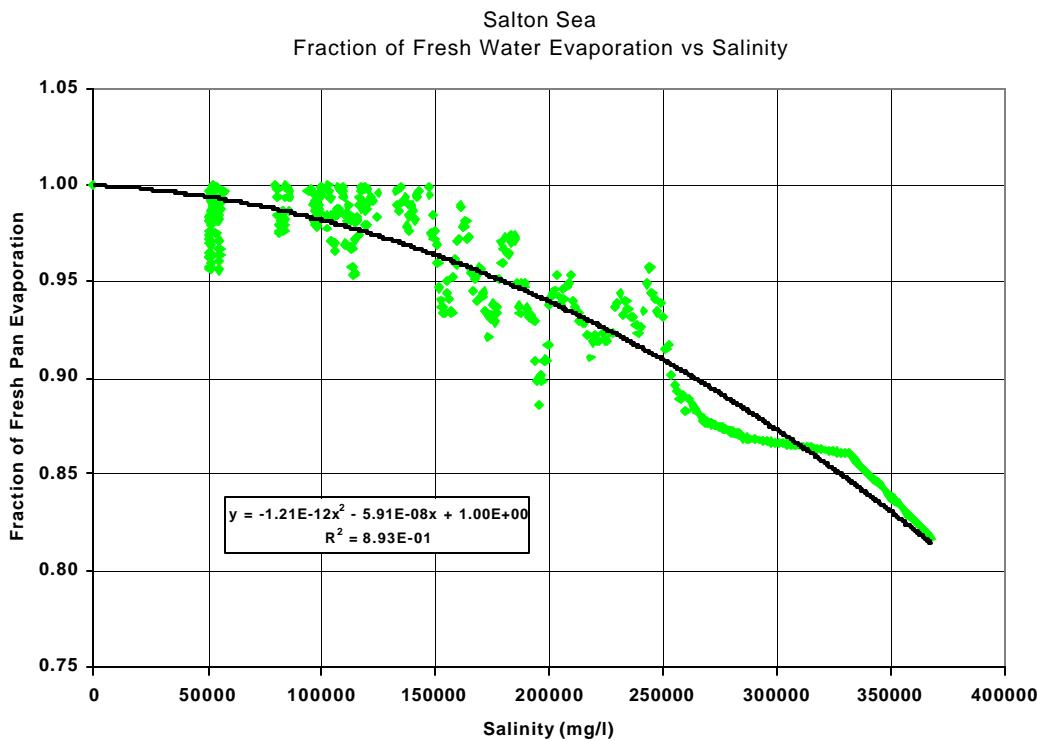
The objectives behind the development of the Salton Sea Accounting Model were to provide a tool that would allow the effective evaluation of historic, present, and future conditions within the Salton Sea. Specifically, the model was developed to provide predictions of changes in elevation, surface area, and salinity based on changes in inflow. Special operating requirements included the need to simulate:

- Future changes in elevation
- Future changes in salt loads into the Sea
- Imports of water
- Exports of water
- In-Sea ponds

5.2 - Evaporation as a Function of Salinity

As salinity increases in the Salton Sea it is expected that evaporation rate reductions will occur. Reclamation in Denver, Colorado, conducted a research project that resulted in developing a relationship that depicts how evaporation will decrease as a function of salinity. Figure 5.1 presents this relationship whereby the effect of salinity is expressed as a fraction of fresh water pan evaporation. Given a specific salinity, the presented curve and equation can be used to calculate a fractional adjustment to the net term evaporation data. This relationship is built into the model whereby the adjustments to net term evaporation are made on annual basis. At 50,000 mg/L salinity levels, the adjustment to salinity is about 0.99. At 100,000 mg/L, the adjustment to net evaporation is about 0.975. At 325,000 mg/L, the adjustment would be 0.85. The adjustments, therefore, are not significant in the salinity ranges expected in the Salton Sea in the near future.

Figure 5.1



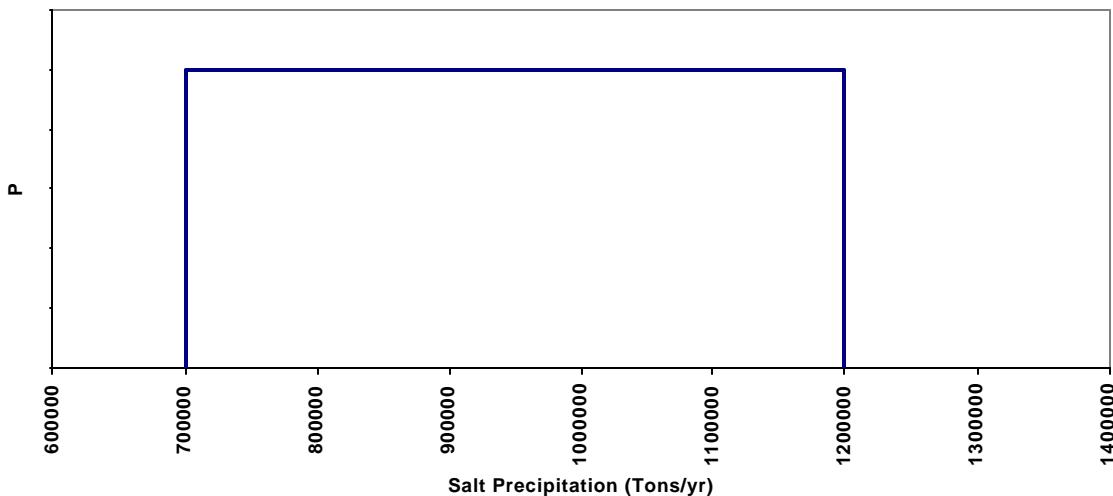
5.3 - Precipitation of Dissolved Solids

In December 2000, a Science Workshop was held in Riverside, California, to develop a joint opinion of scientists with knowledge in the field of salinity, salt precipitation, and biological reduction of sulfates within natural waters. It was concluded, and presented, in a yet to be published paper that dissolved solids are either being precipitated or biologically reduced within the Salton Sea as dissolved salts are added to Sea waters on an annual basis. It was concluded that, at a minimum, 0.7 million tons per year of salts dissolved in inflow waters are being precipitated upon mixing in the Sea. It was also concluded that, at a maximum, 1.2 million tons per year are either being precipitated and/or biologically reduced. If biologic reductions are occurring, then they could be, for example, through actions of sulfate reducing bacteria.

Given the wide range of possibilities that exist between 700,000 and 1.2 million tons per year, the Salton Sea Accounting Model was developed such that this issue was handled as an uncertainty term. When the model is operated in a stochastic mode, a different value for precipitation of dissolved solids is sampled from a uniform probability distribution (figure 5.2) defined by the limits of 700,000 and 1.2 million tons per year. The model then reduces the salt load to the Sea on an annual basis by a corresponding amount to that which is sampled from the distribution. This results in model simulations that account for the uncertainty of how dissolved solids are precipitated or reduced within the Salton Sea.

Figure 5.2

Uniform Distribution
Salt Precipitation (or Reduction) in the Salton Sea
Based on Findings of Precipitation Workshop - January 30, 2000



5.4 - Modes of Operation

The Salton Sea Accounting Model incorporates the ability to perform stochastic and deterministic simulations of the Salton Sea. Deterministic simulations of the model assume that the hydrologic and salt load variability of the Sea will repeat in the future exactly in the same pattern as in the present level water budget. During stochastic simulations of the Salton Sea, random samples are taken from IID water inflow and salt load data for present level conditions as well as from the dissolved solid precipitation distribution presented above. In addition, net term evaporation is sampled in paired fashion to corresponding present level inflow data from IID. In this mode, the model is typically executed 1,000 times and statistics related to model results are compiled. These statistics include for each year: mean values, mean values plus one standard deviation, mean values minus one standard deviation, 5 percentiles, and 95 percentiles. The data are to be interpreted as follows:

95 Percentile: 95 percent of all model traces resulted in values less than or equal to the indicated values

5 Percentile: 5 percent of all model traces resulted in values less than or equal to the indicated values

Mean: Mean of all traces

-1 Standard Deviation: Values representing one standard deviation below the mean

+1 Standard Deviation: Values representing one standard deviation above the mean

5.5 - Area/Elevation/Capacity

In 1995, the Bureau of Reclamation conducted an extensive survey of the Salton Sea (Reclamation, 1997). The survey was to develop underwater topography and to compute area/elevation/capacity relationships for the Sea. This survey did not incorporate existing levees around the shoreline of the Salton Sea. As a result, the area/elevation/capacity data that was developed was not accurate at higher elevations. In the summer of 1999, Reclamation updated this survey data to reflect the influences of the existing levees on the area/elevation/capacity relationships. This was accomplished through the digitization of the Salton Sea shoreline from digital orthophoto quadrangles. Levees were identified along this shoreline and assigned an elevation of -220 feet. The two resulting elevation data (shoreline and levees) were merged into the 1995 survey data. New area/elevation/capacity data were then computed using Reclamation's reservoir survey software. Table 5.1 contains this data. This information was incorporated into the Salton Sea Accounting Model to interpolate elevations and surface areas for each year of model operation. The Model keeps a running accounting of water in storage and, using the data contained in Table 5.1, the model can interpolate elevations and water surface areas.

Figures 5.3 through 5.5 contain Area / Capacity, Elevation / Capacity, and Elevation / Area curves respectively. These charts give an overview of how area, elevation, and storage capacity within the Salton Sea vary.

TABLE 5.1
Salton Sea Elevation / Area / Capacity Data
Based on Revised 1995 Hydrographic GPS Survey Data
Includes Influences Due to Shoreline Levees Not Included in 1995 Survey
(September 1999)

Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)												
-278.6	0	0	-275.5	17626	20016	-272.4	52416	127310	-269.3	88765	346460	-266.2	108550	654946
-278.5	1	0	-275.4	18573	21826	-272.3	53527	132607	-269.2	89598	355378	-266.1	109068	665826
-278.4	9	1	-275.3	19508	23730	-272.2	54652	138016	-269.1	90441	364380	-266	109576	676759
-278.3	27	2	-275.2	20479	25729	-272.1	55837	143541	-269	91260	373465	-265.9	110072	687741
-278.2	70	7	-275.1	21439	27825	-272	57012	149183	-268.9	92038	382630	-265.8	110574	698773
-278.1	193	20	-275	22315	30013	-271.9	58201	154944	-268.8	92798	391872	-265.7	111075	709856
-278	441	52	-274.9	23193	32288	-271.8	59399	160824	-268.7	93524	401188	-265.6	111580	720989
-277.9	789	114	-274.8	24086	34652	-271.7	60602	166824	-268.6	94241	410576	-265.5	112096	732172
-277.8	1209	214	-274.7	25087	37111	-271.6	61814	172945	-268.5	94916	420034	-265.4	112590	743407
-277.7	1681	358	-274.6	26113	39671	-271.5	63089	179190	-268.4	95608	429560	-265.3	113076	754690
-277.6	2145	549	-274.5	27254	42339	-271.4	64343	185562	-268.3	96313	439156	-265.2	113563	766022
-277.5	2619	787	-274.4	28712	45138	-271.3	65495	192053	-268.2	97003	448822	-265.1	114034	777402
-277.4	3168	1077	-274.3	30247	48086	-271.2	66672	198662	-268.1	97668	458555	-265	114510	788829
-277.3	3734	1422	-274.2	31717	51184	-271.1	67870	205389	-268	98332	468355	-264.9	114981	800304
-277.2	4341	1826	-274.1	33113	54425	-271	69137	212239	-267.9	98966	478220	-264.8	115453	811825
-277.1	5001	2293	-274	34430	57803	-270.9	70342	219213	-267.8	99580	488148	-264.7	115925	823394
-277	5705	2828	-273.9	35638	61306	-270.8	71507	226305	-267.7	100199	498137	-264.6	116398	835010
-276.9	6439	3435	-273.8	36765	64926	-270.7	72618	233512	-267.6	100834	508188	-264.5	116872	846674
-276.8	7273	4121	-273.7	37864	68658	-270.6	73722	240829	-267.5	101448	518302	-264.4	117345	858385
-276.7	8088	4889	-273.6	38998	72501	-270.5	74768	248253	-267.4	102038	528477	-264.3	117818	870143
-276.6	8897	5738	-273.5	40144	76458	-270.4	75837	255783	-267.3	102632	538710	-264.2	118300	881949
-276.5	9666	6666	-273.4	41296	80530	-270.3	76913	263421	-267.2	103206	549002	-264.1	118772	893802
-276.4	10409	7670	-273.3	42395	84714	-270.2	78140	271174	-267.1	103780	559351	-264	119248	905703
-276.3	11130	8747	-273.2	43498	89009	-270.1	79448	279053	-267	104350	569758	-263.9	119723	917652
-276.2	11793	9893	-273.1	44578	93413	-270	80635	287057	-266.9	104909	580221	-263.8	120187	929647
-276.1	12438	11105	-273	45669	97925	-269.9	81786	295178	-266.8	105448	590739	-263.7	120653	941689
-276	13115	12382	-272.9	46712	102544	-269.8	82977	303416	-266.7	105977	601310	-263.6	121108	953777
-275.9	13858	13731	-272.8	47797	107270	-269.7	84276	311779	-266.6	106513	611934	-263.5	121580	965912
-275.8	14718	15160	-272.7	48941	112107	-269.6	85610	320273	-266.5	107020	622611	-263.4	122042	978093
-275.7	15699	16681	-272.6	50094	117058	-269.5	86826	328895	-266.4	107527	633339	-263.3	122494	990320
-275.6	16692	18300	-272.5	51265	122126	-269.4	87852	337629	-266.3	108031	644116	-263.2	122931	1002591

Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)
-263.1	123362	1014905	-260	135199	1416184	-256.9	145399	1851301	-253.8	155220	2317466	-250.7	164257	2812727
-263	123787	1027263	-259.9	135553	1429722	-256.8	145739	1865858	-253.7	155523	2333003	-250.6	164553	2829167
-262.9	124200	1039662	-259.8	135899	1443294	-256.7	146069	1880448	-253.6	155830	2348571	-250.5	164850	2845638
-262.8	124619	1052103	-259.7	136244	1456902	-256.6	146395	1895071	-253.5	156139	2364169	-250.4	165147	2862137
-262.7	125031	1064586	-259.6	136583	1470543	-256.5	146718	1909727	-253.4	156445	2379798	-250.3	165436	2878667
-262.6	125439	1077109	-259.5	136920	1484218	-256.4	147036	1924415	-253.3	156748	2395458	-250.2	165723	2895225
-262.5	125840	1089673	-259.4	137259	1497927	-256.3	147360	1939134	-253.2	157046	2411148	-250.1	166013	2911811
-262.4	126235	1102277	-259.3	137597	1511670	-256.2	147681	1953886	-253.1	157337	2426867	-250	166300	2928427
-262.3	126618	1114920	-259.2	137936	1525446	-256.1	148009	1968671	-253	157631	2442615	-249.9	166588	2945071
-262.2	127008	1127601	-259.1	138268	1539257	-256	148330	1983488	-252.9	157923	2458393	-249.8	166876	2961745
-262.1	127401	1140321	-259	138598	1553100	-255.9	148655	1998337	-252.8	158211	2474200	-249.7	167174	2978447
-262	127796	1153081	-258.9	138926	1566976	-255.8	148975	2013219	-252.7	158497	2490035	-249.6	167476	2995180
-261.9	128191	1165880	-258.8	139254	1580885	-255.7	149289	2028132	-252.6	158782	2505899	-249.5	167785	3011943
-261.8	128576	1178719	-258.7	139580	1594827	-255.6	149601	2043076	-252.5	159067	2521791	-249.4	168090	3028736
-261.7	128959	1191596	-258.6	139902	1608801	-255.5	149918	2058052	-252.4	159351	2537712	-249.3	168397	3045561
-261.6	129340	1204511	-258.5	140221	1622807	-255.4	150233	2073060	-252.3	159634	2553662	-249.2	168702	3062416
-261.5	129715	1217463	-258.4	140547	1636845	-255.3	150543	2088099	-252.2	159918	2569639	-249.1	169008	3079301
-261.4	130089	1230453	-258.3	140874	1650916	-255.2	150853	2103168	-252.1	160200	2585645	-249	169311	3096217
-261.3	130464	1243481	-258.2	141196	1665020	-255.1	151172	2118270	-252	160481	2601679	-248.9	169621	3113164
-261.2	130837	1256546	-258.1	141520	1679156	-255	151497	2133403	-251.9	160764	2617741	-248.8	169932	3130141
-261.1	131214	1269649	-258	141849	1693324	-254.9	151832	2148570	-251.8	161045	2633832	-248.7	170249	3147150
-261	131581	1282788	-257.9	142171	1707525	-254.8	152158	2163769	-251.7	161326	2649950	-248.6	170567	3164191
-260.9	131946	1295965	-257.8	142492	1721758	-254.7	152476	2179001	-251.6	161613	2666097	-248.5	170892	3181264
-260.8	132311	1309178	-257.7	142813	1736024	-254.6	152786	2194264	-251.5	161901	2682273	-248.4	171222	3198370
-260.7	132672	1322427	-257.6	143132	1750321	-254.5	153092	2209558	-251.4	162185	2698477	-248.3	171553	3215509
-260.6	133034	1335712	-257.5	143449	1764650	-254.4	153397	2224882	-251.3	162471	2714710	-248.2	171889	3232681
-260.5	133398	1349034	-257.4	143773	1779011	-254.3	153697	2240237	-251.2	162763	2730972	-248.1	172225	3249886
-260.4	133759	1362391	-257.3	144092	1793404	-254.2	154000	2255622	-251.1	163059	2747263	-248	172565	3267126
-260.3	134123	1375785	-257.2	144415	1807830	-254.1	154305	2271037	-251	163361	2763584	-247.9	172911	3284400
-260.2	134483	1389216	-257.1	144739	1822287	-254	154611	2286483	-250.9	163662	2779935	-247.8	173266	3301708
-260.1	134843	1402682	-257	145065	1836777	-253.9	154915	2301959	-250.8	163961	2796316	-247.7	173639	3319054

Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)												
-247.6	174005	3336436	-244.5	185646	3893530	-241.4	197570	4488430	-238.3	207554	5116905	-235.2	2166669	5775237
-247.5	174361	3353854	-244.4	186042	3912115	-241.3	197924	4508204	-238.2	207865	5137676	-235.1	216929	5796917
-247.4	174720	3371308	-244.3	186450	3930739	-241.2	198281	4528015	-238.1	208175	5158478	-235	217196	5818624
-247.3	175073	3388798	-244.2	186860	3949405	-241.1	198638	4547860	-238	208485	5179311	-234.9	217466	5840357
-247.2	175423	3406323	-244.1	187288	3968112	-241	198993	4567742	-237.9	208793	5200175	-234.8	217731	5862116
-247.1	175775	3423883	-244	187726	3986863	-240.9	199349	4587659	-237.8	209112	5221070	-234.7	217987	5883902
-247	176129	3441478	-243.9	188174	4005658	-240.8	199707	4607612	-237.7	209438	5241998	-234.6	218238	5905714
-246.9	176484	3459108	-243.8	188619	4024497	-240.7	200058	4627600	-237.6	209765	5262958	-234.5	218483	5927550
-246.8	176844	3476775	-243.7	189073	4043382	-240.6	200411	4647624	-237.5	210098	5283951	-234.4	218722	5949410
-246.7	177212	3494478	-243.6	189532	4062312	-240.5	200747	4667682	-237.4	210427	5304977	-234.3	218956	5971294
-246.6	177591	3512218	-243.5	189966	4081287	-240.4	201075	4687773	-237.3	210759	5326036	-234.2	219188	5993201
-246.5	177968	3529996	-243.4	190376	4100304	-240.3	201402	4707896	-237.2	211106	5347130	-234.1	219416	6015131
-246.4	178350	3547812	-243.3	190767	4119361	-240.2	201726	4728053	-237.1	211467	5368258	-234	219640	6037084
-246.3	178738	3565666	-243.2	191145	4138457	-240.1	202043	4748241	-237	211809	5389422	-233.9	219861	6059059
-246.2	179109	3583558	-243.1	191516	4157590	-240	202360	4768461	-236.9	212136	5410619	-233.8	220082	6081056
-246.1	179483	3601488	-243	191887	4176760	-239.9	202678	4788713	-236.8	212449	5431849	-233.7	220299	6103075
-246	179860	3619455	-242.9	192255	4195967	-239.8	202992	4808997	-236.7	212743	5453108	-233.6	220515	6125116
-245.9	180242	3637460	-242.8	192632	4215212	-239.7	203297	4829311	-236.6	213028	5474397	-233.5	220729	6147178
-245.8	180621	3655503	-242.7	192994	4234493	-239.6	203608	4849657	-236.5	213309	5495714	-233.4	220943	6169262
-245.7	181000	3673584	-242.6	193364	4253811	-239.5	203916	4870033	-236.4	213582	5517058	-233.3	221149	6191366
-245.6	181378	3691703	-242.5	193735	4273166	-239.4	204218	4890439	-236.3	213852	5538430	-233.2	221354	6213491
-245.5	181754	3709860	-242.4	194105	4292558	-239.3	204518	4910876	-236.2	214120	5559829	-233.1	221553	6235637
-245.4	182127	3728054	-242.3	194469	4311986	-239.2	204819	4931343	-236.1	214385	5581254	-233	221752	6257802
-245.3	182499	3746285	-242.2	194841	4331452	-239.1	205123	4951840	-236	214646	5602705	-232.9	221952	6279987
-245.2	182868	3764554	-242.1	195204	4350954	-239	205426	4972368	-235.9	214910	5624183	-232.8	222151	6302192
-245.1	183245	3782859	-242	195554	4370492	-238.9	205725	4992925	-235.8	215165	5645687	-232.7	222350	6324417
-245	183640	3801204	-241.9	195894	4390064	-238.8	206027	5013513	-235.7	215417	5667216	-232.6	222547	6346662
-244.9	184040	3819588	-241.8	196229	4409671	-238.7	206331	5034131	-235.6	215668	5688770	-232.5	222744	6368927
-244.8	184454	3838012	-241.7	196560	4429310	-238.6	206630	5054779	-235.5	215917	5710349	-232.4	222941	6391211
-244.7	184868	3856478	-241.6	196899	4448983	-238.5	206932	5075457	-235.4	216168	5731954	-232.3	223138	6413515
-244.6	185261	3874985	-241.5	197231	4468690	-238.4	207238	5096165	-235.3	216419	5753583	-232.2	223336	6435839

Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)
-232.1	223535	6458182	-229	229868	7160886	-225.9	236510	7883682	-222.8	243497	8627612						
-232	223734	6480546	-228.9	230077	7183883	-225.8	236730	7907344	-222.7	243727	8651974						
-231.9	223934	6502929	-228.8	230286	7206902	-225.7	236950	7931028	-222.6	243958	8676358						
-231.8	224134	6525333	-228.7	230496	7229941	-225.6	237171	7954734	-222.5	244190	8700765						
-231.7	224335	6547756	-228.6	230705	7253001	-225.5	237392	7978462	-222.4	244421	8725196						
-231.6	224536	6570200	-228.5	230916	7276082	-225.4	237613	8002212	-222.3	244653	8749650						
-231.5	224737	6592663	-228.4	231126	7299184	-225.3	237835	8025985	-222.2	244885	8774126						
-231.4	224939	6615147	-228.3	231337	7322307	-225.2	238057	8049779	-222.1	245118	8798627						
-231.3	225141	6637651	-228.2	231549	7345451	-225.1	238280	8073596	-222	245351	8823150						
-231.2	225344	6660175	-228.1	231761	7368617	-225	238502	8097435	-221.9	245584	8847697						
-231.1	225547	6682720	-228	231973	7391803	-224.9	238733	8121297	-221.8	245818	8872267						
-231	225750	6705285	-227.9	232185	7415011	-224.8	238957	8145182	-221.7	246052	8896860						
-230.9	225953	6727870	-227.8	232398	7438240	-224.7	239180	8169088	-221.6	246286	8921477						
-230.8	226157	6750475	-227.7	232611	7461491	-224.6	239404	8193018	-221.5	246521	8946118						
-230.7	226361	6773101	-227.6	232825	7484763	-224.5	239629	8216969	-221.4	246756	8970782						
-230.6	226565	6795748	-227.5	233038	7508056	-224.4	239854	8240943	-221.3	246991	8995469						
-230.5	226769	6818414	-227.4	233253	7531370	-224.3	240079	8264940	-221.2	247227	9020180						
-230.4	226974	6841101	-227.3	233467	7554706	-224.2	240304	8288959	-221.1	247463	9044914						
-230.3	227180	6863809	-227.2	233682	7578064	-224.1	240530	8313001	-221	247699	9069672						
-230.2	227385	6886537	-227.1	233898	7601443	-224	240756	8337065	-220.9	247936	9094454						
-230.1	227592	6909286	-227	234113	7624843	-223.9	240983	8361152	-220.8	248173	9119260						
-230	227798	6932056	-226.9	234329	7648266	-223.8	241210	8385262	-220.7	248410	9144089						
-229.9	228004	6954846	-226.8	234546	7671709	-223.7	241437	8409394	-220.6	248648	9168942						
-229.8	228210	6977657	-226.7	234763	7695175	-223.6	241664	8433549	-220.5	248886	9193818						
-229.7	228416	7000488	-226.6	234980	7718662	-223.5	241892	8457727	-220.4	249125	9218719						
-229.6	228622	7023340	-226.5	235197	7742171	-223.4	242121	8481928	-220.3	249363	9243643						
-229.5	228829	7046212	-226.4	235415	7765701	-223.3	242349	8506151	-220.2	249602	9268592						
-229.4	229036	7069106	-226.3	235633	7789254	-223.2	242578	8530398	-220.1	249842	9293564						
-229.3	229243	7092020	-226.2	235852	7812828	-223.1	242807	8554667	-220	250082	9318560						
-229.2	229451	7114954	-226.1	236071	7836424	-223	243037	8578959									
-229.1	229659	7137910	-226	236290	7860042	-222.9	243267	8603274									

Figure 5.3

Salton Sea
Area / Capacity Curve
Based on Revised 1995 Survey Data

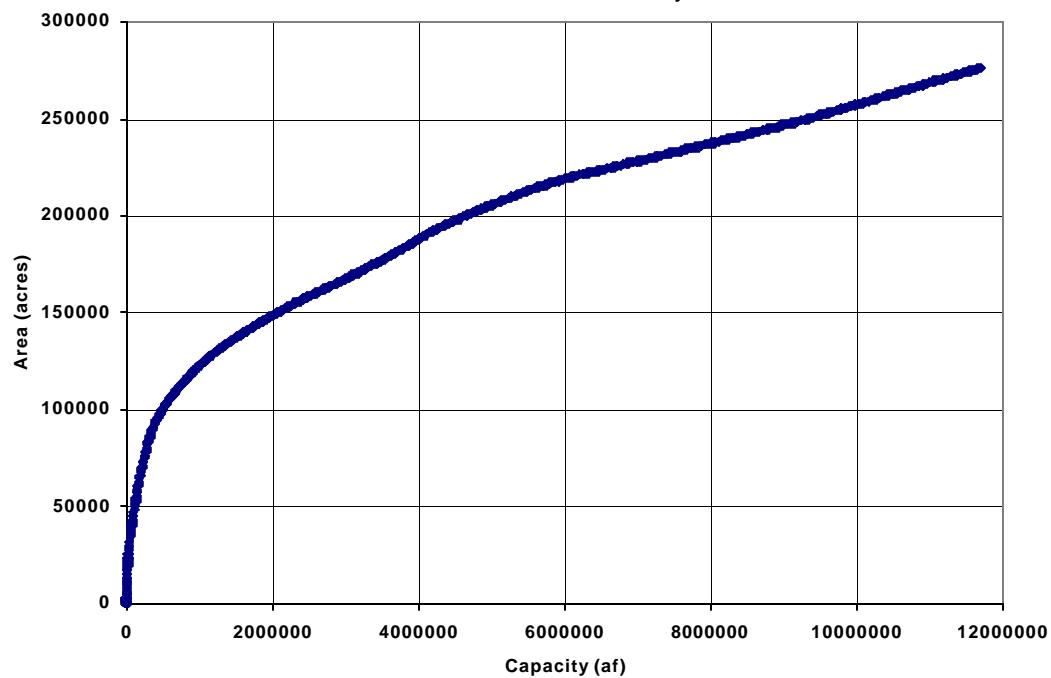


Figure 5.4

Salton Sea
Elevation / Capacity Curve
Based on Revised 1995 Survey Data

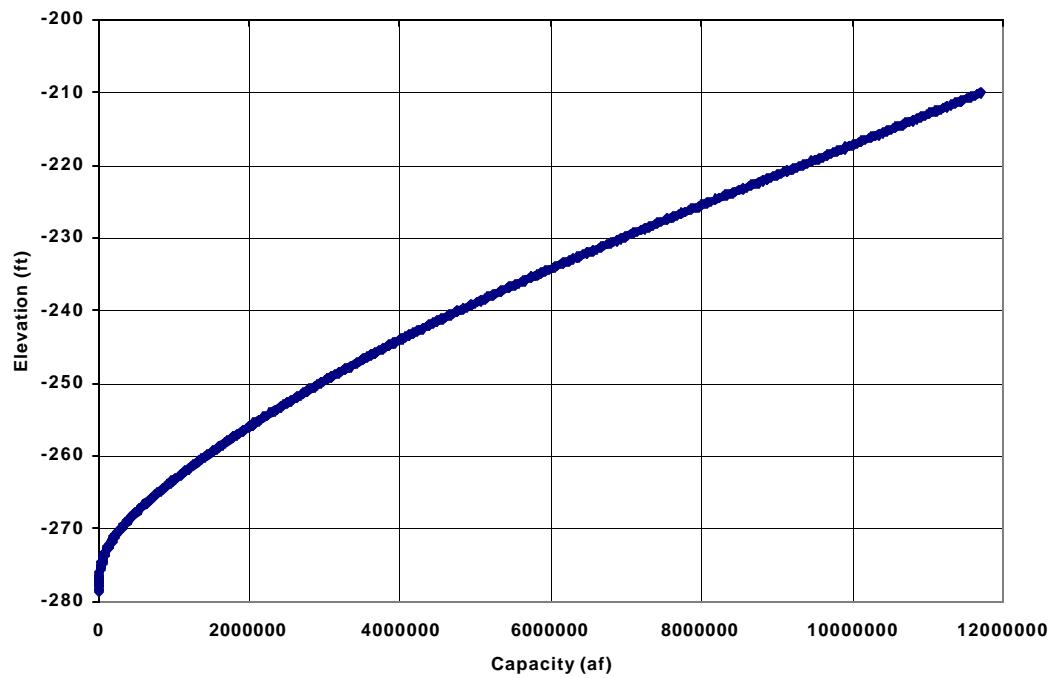
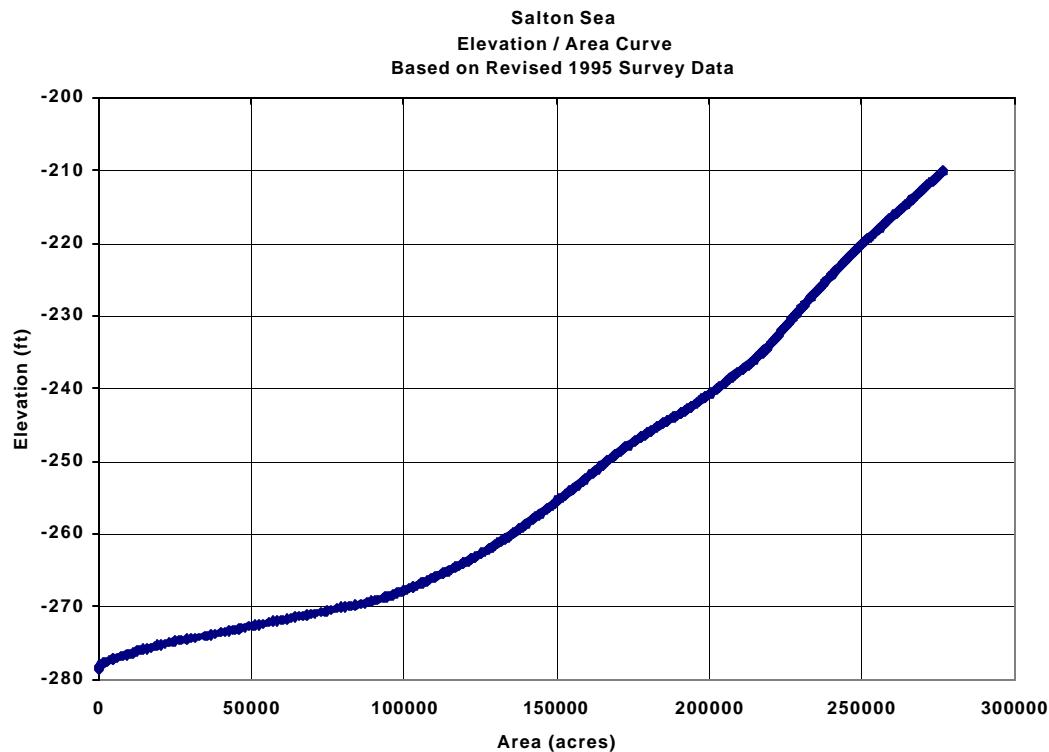


Figure 5.5



6.0 - Future Inflows and Salt Loads

6.1 - Conservation Ramp-up Schedules

Future inflows to the Salton Sea are expected to decline. The most likely program that will have an effect on inflows is a transfer of water from IID to the San Diego County Water Authority (SDCWA), CVWD and/or MWD. The amount of water that could be transferred to San Diego is between 130,000 af per year and 200,000 af per yr. The amount of water to be transferred to CVWD and/or MWD is 100,000 af per year. Implementation of these transfers are to be based upon conservation efforts within the IID service area. The possible transfer scenarios are expected to follow ramp-up schedules as presented in Table 6.1. The information provided in Table 6.1 was provided by IID based on the IID/SDCWA transfer and Quantification Settlement Agreement modeling effort.

Table 6.1
Ramp-up Schedules for Reductions in Inflow 1/
Due to Conservation Measures

Year	Following Conservation			Conservation		Following Conservation	
	Ramp up 130 KAF to SDCWA	Ramp up 300 KAF to SDCWA	Ramp up 300 KAF to SDCWA	Ramp up 130 KAF to SDCWA	Ramp up 200 KAF to SDCWA	Ramp up 200 KAF to SDCWA	Ramp up 200 KAF to SDCWA
Year	(af)						
2000	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0
2002	-20000	-20000	-6220	-20000	-20000	-6220	
2003	-40000	-40000	-12440	-40000	-40000	-12440	
2004	-60000	-60000	-18660	-60000	-60000	-18660	
2005	-80000	-80000	-24880	-85000	-85000	-26435	
2006	-100000	-100000	-31100	-110000	-110000	-34210	
2007	-120000	-120000	-37320	-130000	-130000	-40430	
2008	-130000	-140000	-43540	-140000	-150000	-46650	
2009	-130000	-160000	-49760	-145000	-175000	-54425	
2010	-130000	-180000	-55980	-150000	-200000	-62200	
2011	-130000	-200000	-62200	-155000	-225000	-69975	
2012	-130000	-210000	-65310	-160000	-230000	-71530	
2013	-130000	-220000	-68420	-165000	-235000	-73085	
2014	-130000	-230000	-71530	-170000	-240000	-74640	
2015	-130000	-240000	-74640	-175000	-245000	-76195	
2016	-130000	-250000	-77750	-180000	-250000	-77750	
2017	-130000	-260000	-80860	-185000	-255000	-79305	
2018	-130000	-270000	-83970	-190000	-260000	-80860	
2019	-130000	-280000	-87080	-195000	-265000	-82415	
2020	-130000	-290000	-90190	-200000	-270000	-83970	
2021	-130000	-300000	-93300	-205000	-275000	-85525	
2022	-130000	-300000	-93300	-210000	-280000	-87080	
2023	-130000	-300000	-93300	-215000	-285000	-88635	
2024	-130000	-300000	-93300	-220000	-290000	-90190	
2025	-130000	-300000	-93300	-225000	-295000	-91745	
2026	-130000	-300000	-93300	-230000	-300000	-93300	
2027	-130000	-300000	-93300	-230000	-300000	-93300	
2028	-130000	-300000	-93300	-230000	-300000	-93300	
2029	-130000	-300000	-93300	-230000	-300000	-93300	
2030	-130000	-300000	-93300	-230000	-300000	-93300	
2031	-130000	-300000	-93300	-230000	-300000	-93300	
2032	-130000	-300000	-93300	-230000	-300000	-93300	
2033	-130000	-300000	-93300	-230000	-300000	-93300	
2034	-130000	-300000	-93300	-230000	-300000	-93300	
2035	-130000	-300000	-93300	-230000	-300000	-93300	
2036	-130000	-300000	-93300	-230000	-300000	-93300	
2037	-130000	-300000	-93300	-230000	-300000	-93300	
2038	-130000	-300000	-93300	-230000	-300000	-93300	

Year	Fallowing Conservation			Conservation			Fallowing Conservation		
	Ramp up 130 KAF to SDCWA	Ramp up 300 KAF to SDCWA	Ramp up 300 KAF to SDCWA	Ramp up 130 KAF to SDCWA	& 100 KAF to CVWD	& 100 KAF to CVWD	Ramp up 200 KAF to SDCWA	& 100 KAF to CVWD	Ramp up 200 KAF to SDCWA
	(af)	(af)	(af)	(af)	(af)	(af)	(af)	(af)	(af)
2039	-130000	-300000	-93300		-230000		-300000		-93300
2040	-130000	-300000	-93300		-230000		-300000		-93300
2041	-130000	-300000	-93300		-230000		-300000		-93300
2042	-130000	-300000	-93300		-230000		-300000		-93300
2043	-130000	-300000	-93300		-230000		-300000		-93300
2044	-130000	-300000	-93300		-230000		-300000		-93300
2045	-130000	-300000	-93300		-230000		-300000		-93300
2046	-130000	-300000	-93300		-230000		-300000		-93300
2047	-130000	-300000	-93300		-230000		-300000		-93300
2048	-130000	-300000	-93300		-230000		-300000		-93300
2049	-130000	-300000	-93300		-230000		-300000		-93300
2050	-130000	-300000	-93300		-230000		-300000		-93300
2051	-130000	-300000	-93300		-230000		-300000		-93300
2052	-130000	-300000	-93300		-230000		-300000		-93300
2053	-130000	-300000	-93300		-230000		-300000		-93300
2054	-130000	-300000	-93300		-230000		-300000		-93300
2055	-130000	-300000	-93300		-230000		-300000		-93300
2056	-130000	-300000	-93300		-230000		-300000		-93300
2057	-130000	-300000	-93300		-230000		-300000		-93300
2058	-130000	-300000	-93300		-230000		-300000		-93300
2059	-130000	-300000	-93300		-230000		-300000		-93300
2060	-130000	-300000	-93300		-230000		-300000		-93300
2061	-130000	-300000	-93300		-230000		-300000		-93300
2062	-130000	-300000	-93300		-230000		-300000		-93300
2063	-130000	-300000	-93300		-230000		-300000		-93300
2064	-130000	-300000	-93300		-230000		-300000		-93300
2065	-130000	-300000	-93300		-230000		-300000		-93300
2066	-130000	-300000	-93300		-230000		-300000		-93300
2067	-130000	-300000	-93300		-230000		-300000		-93300
2068	-130000	-300000	-93300		-230000		-300000		-93300
2069	-130000	-300000	-93300		-230000		-300000		-93300
2070	-130000	-300000	-93300		-230000		-300000		-93300
2071	-130000	-300000	-93300		-230000		-300000		-93300
2072	-130000	-300000	-93300		-230000		-300000		-93300
2073	-130000	-300000	-93300		-230000		-300000		-93300
2074	-130000	-300000	-93300		-230000		-300000		-93300

1/ Provided by Imperial Irrigation District

6.2 - Salt Load Changes with Conservation

Table 6.2 presents a summary of forecasted changes in salt load under each of the conservation scenarios presented in Table 6.1. Information to develop table 6.2 was provided by IID. This data comes from other computer models and is representative of diversions by IID of water at Imperial Dam with salinity levels at 879 mg/L.

Table 6.2
Salt Load Reductions 1/
To The Salton Sea
Due to Conservation

Year	Salt Load		Fallowing		Salt Load		Salt Load		Fallowing		
	Reductions from IID		Salt Load		Reductions from IID		Reductions from IID		Salt Load		
	130 KAF To SDCWA	300 KAF to SDCWA	300 KAF to SDCWA	(tons)	130 KAF to SDCWA	& 100 KAF to CVWD	(tons)	Ramp up to SDCWA	200 KAF to SDCWA	& 100 KAF to CVWD	(tons)
2000	0	0	0	0	0		0	0	0		0
2001	0	0	0	0	0		0	0	0		0
2002	-24000	-24000	-24000	-24000	-24000		-24000	-24000	-24000		-24000
2003	-48000	-48000	-48000	-48000	-48000		-48000	-48000	-48000		-48000
2004	-72000	-72000	-72000	-72000	-72000		-72000	-72000	-72000		-72000
2005	-96000	-96000	-96000	-102000	-102000		-102000	-102000	-102000		-102000
2006	-120000	-120000	-120000	-132000	-132000		-132000	-132000	-132000		-132000
2007	-144000	-144000	-144000	-156000	-156000		-156000	-156000	-156000		-156000
2008	-156000	-168000	-168000	-168000	-168000		-180000	-180000	-180000		-180000
2009	-156000	-192000	-192000	-174000	-174000		-210000	-210000	-210000		-210000
2010	-156000	-216000	-216000	-180000	-180000		-240000	-240000	-240000		-240000
2011	-156000	-240000	-240000	-186000	-186000		-270000	-270000	-270000		-270000
2012	-156000	-252000	-252000	-192000	-192000		-276000	-276000	-276000		-276000
2013	-156000	-264000	-264000	-198000	-198000		-282000	-282000	-282000		-282000
2014	-156000	-276000	-276000	-204000	-204000		-288000	-288000	-288000		-288000
2015	-156000	-288000	-288000	-210000	-210000		-294000	-294000	-294000		-294000
2016	-156000	-300000	-300000	-216000	-216000		-300000	-300000	-300000		-300000
2017	-156000	-312000	-312000	-222000	-222000		-306000	-306000	-306000		-306000
2018	-156000	-324000	-324000	-228000	-228000		-312000	-312000	-312000		-312000
2019	-156000	-336000	-336000	-234000	-234000		-318000	-318000	-318000		-318000
2020	-156000	-348000	-348000	-240000	-240000		-324000	-324000	-324000		-324000
2021	-156000	-360000	-360000	-246000	-246000		-330000	-330000	-330000		-330000
2022	-156000	-360000	-360000	-252000	-252000		-336000	-336000	-336000		-336000
2023	-156000	-360000	-360000	-258000	-258000		-342000	-342000	-342000		-342000
2024	-156000	-360000	-360000	-264000	-264000		-348000	-348000	-348000		-348000

Year	Salt Load		Fallowing		Salt Load		Reductions from IID		Salt Load	
	Reductions from IID		Salt Load	Reductions from IID	Salt Load	Reductions from IID	Ramp up	Reductions from IID	Salt Load	Reductions from IID
	130 KAF To SDCWA	300 KAF to SDCWA	300 KAF to SDCWA	130 KAF to SDCWA	& 100 KAF to CVWD	& 100 KAF to CVWD	& 100 KAF to CVWD	To SDCWA		
Year	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)
2068	-156000	-360000	-360000	-276000	-360000	-360000	-360000			
2069	-156000	-360000	-360000	-276000	-360000	-360000	-360000			
2070	-156000	-360000	-360000	-276000	-360000	-360000	-360000			
2071	-156000	-360000	-360000	-276000	-360000	-360000	-360000			
2072	-156000	-360000	-360000	-276000	-360000	-360000	-360000			
2073	-156000	-360000	-360000	-276000	-360000	-360000	-360000			
2074	-156000	-360000	-360000	-276000	-360000	-360000	-360000			

1/ Provided by Imperial Irrigation District

6.3 – CVWD With Project Flows

Under each of the IID scenarios for conservation and transfer to SDCWA, 100,000 af per year of water is also made available to CVWD. Once the transfer to CVWD begins, there will be changes in both the future water and salt inflows to the Salton Sea from CVWD. Table 6.3 presents future with project flows from CVWD. Table 6.4 shows future with project salt loads from CVWD. Data from both Table 6.3 and 6.4 are presented in chart form in Figure 6.1. As the 100,000 af per year of transferred water is used by CVWD, the Coachella Aquifer will be slowly recharged and both water and salt inflows will increase. CVWD provided this information.

Table 6.3
Future With Project
Inflows to the Salton Sea
From CVWD

Year	Project 1/ Surface Flows to Sea frm CVWD (af)	Project 1/ Aquifer Flows frm CVWD (af)	CVWD 1/ Project Discharge to Sea (af)
2000	77445	-462	76983
2001	75936	-531	75405
2002	75861	-585	75276
2003	76208	-630	75578
2004	78079	-671	77408
2005	79792	-709	79082
2006	76887	-745	76142
2007	77722	-779	76943
2008	73239	-808	72431
2009	74029	-828	73201
2010	75206	-843	74363

Year	Project 1/ Surface Flows to Sea frm CVWD (af)	Project 1/ Aquifer Flows frm CVWD (af)	CVWD 1/ Project Discharge to Sea (af)
2011	77161	-852	76309
2012	79778	-853	78924
2013	78865	-847	78018
2014	82637	-833	81804
2015	86148	-809	85339
2016	89607	-782	88825
2017	93125	-745	92379
2018	96730	-696	96034
2019	100524	-636	99888
2020	104437	-567	103870
2021	108631	-501	108131
2022	112931	-417	112514
2023	112695	-280	112415
2024	117841	-107	117734
2025	122994	82	123076
2026	127939	240	128179
2027	132635	398	133033
2028	136973	540	137513
2029	140812	658	141470
2030	144267	757	145024
2031	147428	838	148266
2032	150349	904	151253
2033	153106	957	154063
2034	155411	999	156410
2035	157304	1032	158335
2036	157377	1059	158436
2037	157256	1081	158337
2038	156965	1098	158062
2039	156522	1111	157633
2040	155948	1122	157070
2041	155260	1130	156390
2042	154472	1136	155608
2043	153598	1141	154739
2044	152650	1145	153794
2045	151637	1148	152785
2046	150570	1150	151720
2047	149455	1152	150607
2048	148300	1153	149453
2049	147110	1154	148264
2050	145890	1155	147045
2051	144645	1156	145801
2052	143378	1156	144534
2053	142092	1157	143249
2054	140791	1157	141948
2055	139476	1157	140633

Year	Project 1/ Surface Flows to Sea frm CVWD (af)	Project 1/ Aquifer Flows frm CVWD (af)	CVWD 1/ Project Discharge to Sea (af)
2056	138150	1157	139307
2057	136813	1157	137971
2058	135469	1158	136626
2059	134117	1158	135275
2060	132759	1158	133917
2061	131396	1158	132554
2062	130029	1158	131186
2063	128657	1158	129815
2064	128676	1158	129834
2065	128691	1158	129849
2066	128705	1158	129863
2067	128716	1158	129874
2068	128726	1158	129884
2069	128734	1158	129892
2070	128741	1158	129899
2071	128747	1158	129905
2072	128752	1158	129910
2073	128756	1158	129914
2074	128760	1158	129918
Average	123167	475	123642

1/ Provided by Coachella Valley Water District

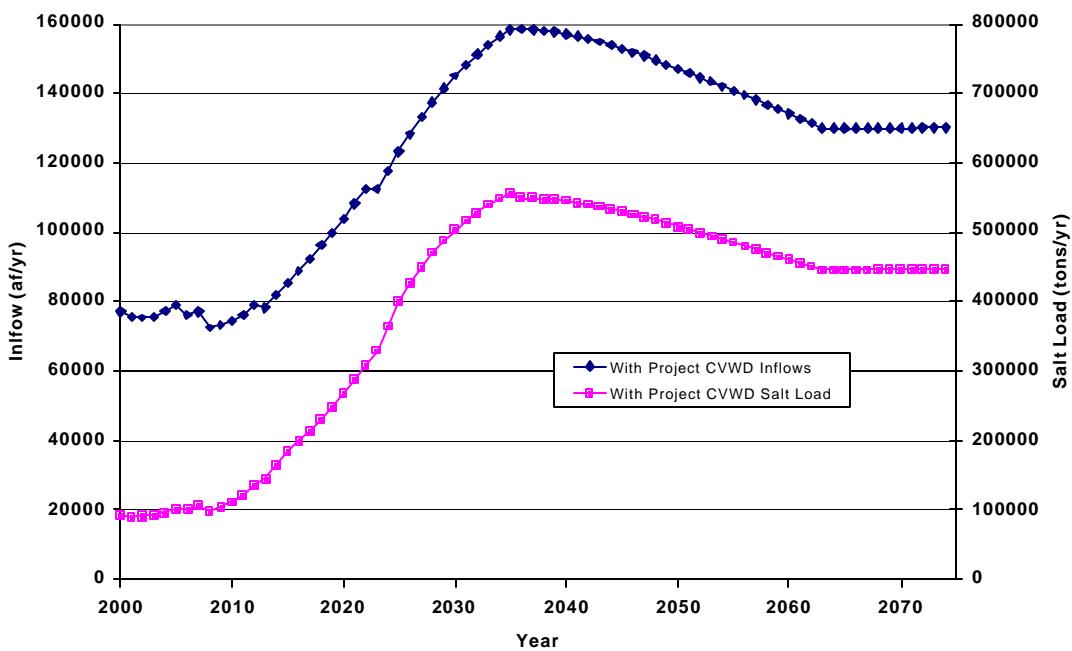
Table 6.4
Future With Project
Salt Load to the Salton Sea
From CVWD

Year	Project 1/ Surface Salt Load to Sea frm CVWD (tons/yr)	Project 1/ Aquifer Salt Load frm CVWD (tons/yr)	CVWD 1/ Project Salt Load to Sea (tons/yr)
2000	166500	-74300	92200
2001	168200	-78300	89900
2002	172100	-81300	90800
2003	176300	-83900	92400
2004	182400	-86100	96300
2005	188700	-88200	100500
2006	191500	-90200	101300
2007	196500	-92000	104500
2008	191800	-93500	98300
2009	198000	-94600	103400
2010	206500	-95300	111200
2011	217200	-95800	121400
2012	231400	-95900	135500
2013	239200	-95500	143700
2014	258200	-94800	163400
2015	278300	-93500	184800
2016	291200	-92000	199200
2017	304400	-90100	214300
2018	317900	-87400	230500
2019	332300	-84100	248200
2020	347100	-80300	266800
2021	363000	-76700	286300
2022	380000	-72100	307900
2023	393500	-64200	329300
2024	418100	-54400	363700
2025	443200	-44100	399100
2026	464500	-38500	426000
2027	485600	-35500	450100
2028	503900	-33400	470500
2029	518900	-31800	487100
2030	533100	-30500	502600
2031	545600	-29500	516100
2032	557000	-28700	528300
2033	567800	-28100	539700
2034	576400	-27600	548800
2035	583300	-27300	556000
2036	576472	-27000	549472
2037	576031	-26800	549231
2038	574962	-26600	548362
2039	573341	-26400	546941

Year	Project 1/ Surface Salt Load to Sea frm CVWD (tons/yr)	Project 1/ Aquifer Salt Load frm CVWD (tons/yr)	CVWD 1/ Project Salt Load to Sea (tons/yr)
2040	571239	-26300	544939
2041	568717	-26300	542417
2042	565831	-26200	539631
2043	562630	-26100	536530
2044	559156	-26100	533056
2045	555448	-26100	529348
2046	551538	-26000	525538
2047	547454	-26000	521454
2048	543223	-26000	517223
2049	538864	-26000	512864
2050	534396	-26000	508396
2051	529834	-26000	503834
2052	525194	-26000	499194
2053	520485	-26000	494485
2054	515718	-26000	489718
2055	510902	-26000	484902
2056	506043	-26000	480043
2057	501148	-26000	475148
2058	496223	-26000	470223
2059	491271	-26000	465271
2060	486297	-25900	460397
2061	481304	-25900	455404
2062	476295	-25900	450395
2063	471272	-25900	445372
2064	471340	-25900	445440
2065	471397	-25900	445497
2066	471446	-25900	445546
2067	471487	-25900	445587
2068	471523	-25900	445623
2069	471553	-25900	445653
2070	471579	-25900	445679
2071	471601	-25900	445701
2072	471619	-25900	445719
2073	471635	-25900	445735
2074	471648	-25900	445748
Average	430503	-46745	383758

1/ Provided by Coachella Valley Water District

Figure 6.1
Future With Project CVWD
Salt Load and Inflows
to the Salton Sea



7.0 — Historic Simulations

7.1 - Model Calibration

To minimize errors introduced into the Model from the estimation of evaporation and precipitation on the Salton Sea, a unique approach was taken. The use of a net term evaporation was applied. This net term was computed during the calibration of the Model such that net evaporation (being defined as Sea evaporation less Sea precipitation) was back calculated as a resultant term in the process of developing the historic water budget presented in Table 2.2. This was accomplished by simultaneously solving for average annual unmeasured inflows and net evaporation. An iterative technique was applied such that unmeasured inflows were adjusted until a back calculated net evaporation term equaled 68 inches on an average annual basis. A value of 68 inches for evaporation was derived as a target from a previous study of Salton Sea evaporation (Hughes 1967) and estimates of average annual precipitation in the Salton Basin. The USGS estimated evaporation from the Salton Sea to be 70.5 inches using a water budget approach. Average annual precipitation over the basin was estimated at 2.5 inches. Subtracting this average annual precipitation value from the 70.5 inches of evaporation resulted in a target of 68 inches for net evaporation. Table 3.1 presents a listing of the net evaporation computed in this process.

The resulting unmeasured inflows derived from the calibration process equals 68,400 af/yr. These unmeasured inflows include tributary inflows not accounted for in IID and CVWD historic data as well as other unaccounted for unmeasured inflows and/or errors resulting for the quantification of historic water budget components. Unmeasured inflows not accounted for in IID and CVWD historic data would include some annual variability not taken into consideration in the adoption of the use of a constant 68,400 af/yr unmeasured inflow to the Sea. However, the inclusion of such variability would have negligible effect on the ability of the model to forecast historic and/or future conditions.

To check calibration, the Salton Sea Accounting Model was applied to simulate historic conditions. The model was run with a starting elevation and salinity equal to –241.3 feet and 38,453 mg/L, respectively. This starting salinity value corresponds to that reported by the USGS and IID, respectively, for the year 1950. The model was executed for the period 1950 to 1999. Figures 7.1 and 7.2 present a comparison of simulated historic and historic measured end-of-year elevation and salinity, respectively. The charts clearly depict that the Salton Sea Accounting Model can adequately simulate historic conditions. This historic simulation was performed using mass balance salt loads to the Salton Sea rather than the historic water budget salt loads provided by IID and CVWD and presented in Table 2.3 above. These mass balance loads were computed based on historic salinity and changes in water storage within the Sea. Use of the mass balance salt load calculations were required for model calibration. However for predicting future conditions they are not accurate. The mass balance computations of salt load include influences of errors in the measurement of salinity and elevation within the Sea. While similar to the water budget salt loads provided in Table 2.3 on an average annual basis

they do not agree year to year. Use of the mass balance numbers in the historic calibrations verifies that the model preserves conservation of mass for both water and salt. The mass balance salt loads were computed from historic salinity records. If there were a problem with mass balance in either water or salt accounting then the model would be unable to replicate historic salinity and elevation values. The small differences in elevation and salinity between historic and simulated historic in Figures 7.1 and 7.2 are due to errors introduced in the interpolation of elevations and surface areas within the model using the above presented area / capacity / elevation data as well as during the calculation of mass balance salt loads.

7.2 – Model Verification

Another set of historic simulations of the Model were performed to verify that the historic salt budget data provided in Table 2.3 accurately represents a history of salt discharges to the sea. Figures 7.3 and 7.4 present comparisons of historic elevation and salinity against simulated historic values based on the use of the historic salt budget data. Again the model is shown to perform very well in the simulation of historic conditions. The comparisons in Figures 7.3 and 7.4, serve to demonstrate that the historic salt load inflows put together by IID and CVWD are indeed accurate.

Based on these favorable results of comparisons of simulated historic and historic conditions as presented in Figures 7.1 through 7.4 the model is calibrated and verified for use in simulating future conditions within the Salton Sea.

Figure 7.1
Model Calibration - Elevation

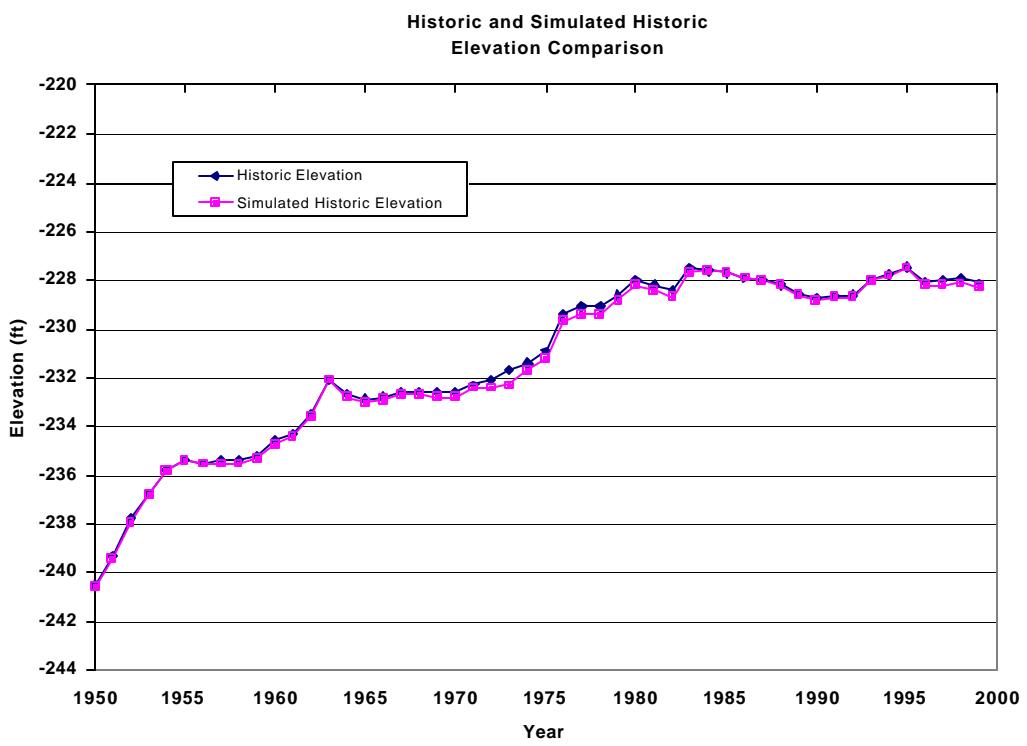


Figure 7.2
Model Calibration - Salinity

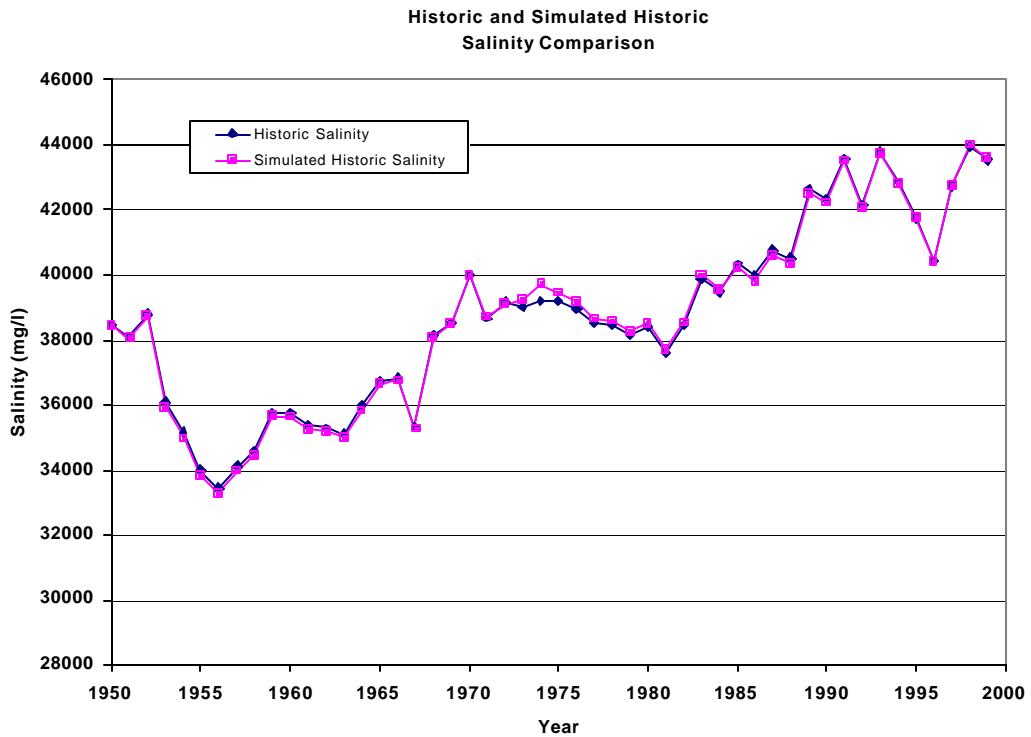


Figure 7.3
Model Verification - Elevation

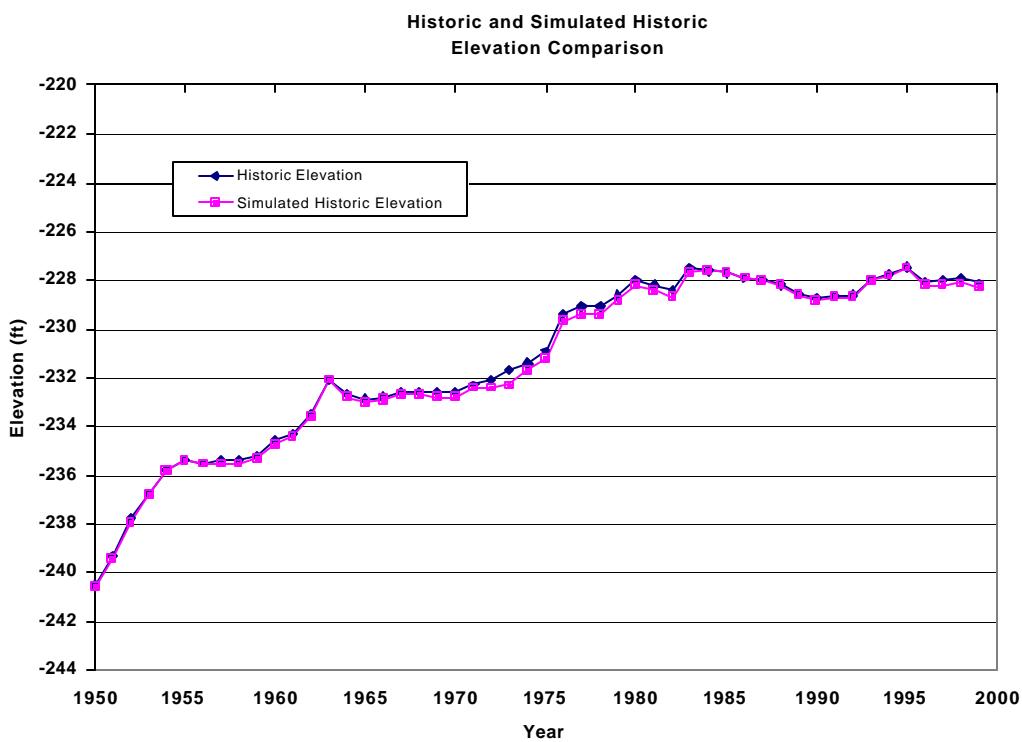
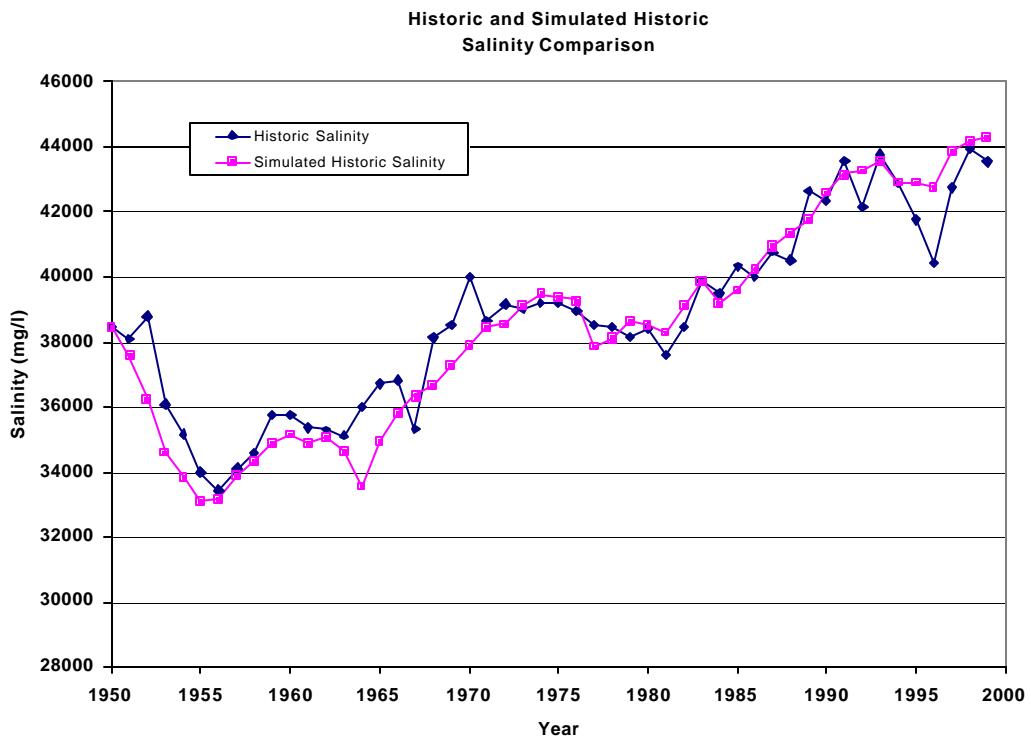


Figure 7.4
Model Verification - Salinity



8.0 — REFERENCES

Hughes, G. H.. 1967. USGS, Analysis of Techniques Used to Measure Evaporation From Salton Sea, California, Geological Survey Professional Paper 272-H.

USGS Sediment Data

RDB file created by NWIS qwflatout program

USGS Station ID STAID 15S	USGS Station Name SNAME 49S	Sample Collection		Sediment Analysis
		Dates DATES	Times TIMES	in mg/L P80154
		8S	4S	9S
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19781016	1230	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19781113	1305	5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790111	830	37
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790215	1100	12
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790312	1130	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790409	1245	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790507	1230	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790611	1215	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790709	1235	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790809	1045	7
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790910	1135	8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19791015	1230	5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19791113	1230	5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19800107	1200	5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19821020	1100	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19821117	900	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19821214	1035	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830119	1200	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830209	1330	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830316	1300	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830419	1400	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830518	1100	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830615	1100	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830721	1210	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830824	830	8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830913	1245	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19841128	1300	3.5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19841219	1100	3.1
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850115	1430	5.1
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850220	1100	2.9
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850417	1100	2.1
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850514	1415	3.5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850611	1355	2.9
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850716	1315	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850821	1300	1.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850905	1030	3.2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19851002	1245	2.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19851119	1400	5.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19851203	1430	1.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860109	1330	2.2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860205	1400	2.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860318	1330	2.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860514	1330	1.6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860626	1230	8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860715	1200	7.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860812	1200	6.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19861008	1400	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19861210	1430	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19870204	1330	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19870408	1430	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19870610	1345	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19871027	1345	2.7
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19871215	1145	1.5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19880224	1145	2.1

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USGS Station ID STAID 15S	USGS Station Name SNAME 49S	Sample Collection		Sediment Analysis
		Dates DATES 8S	Times TIMES 4S	in mg/L P80154 9S
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19880427	1145	1.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19880614	1115	1.6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19880809	1400	2.3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19881025	1245	3.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19881115	1300	4.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19881220	1145	2.3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890124	1300	2.3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890216	1530	0.9
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890313	1300	1.5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890411	1300	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890516	1300	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890614	1200	1.6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890718	1230	2.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890822	1200	3.3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890919	1200	3.2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19891024	1330	3.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19891114	1245	7.7
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19891219	1115	6.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900123	1300	3.9
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900221	1230	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900327	1200	11
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900424	1300	1.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900522	1245	1.7
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900612	1245	1.7
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900724	1230	3.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900814	1300	11
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900905	1300	7.2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19901030	1230	4.9
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19901128	1230	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19901218	1315	3.1
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19910115	1230	1.6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19910212	1230	1.5
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19960819	1000	20
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19961113	1030	12
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19961212	1100	5
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19970212	1015	45
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19970514	1030	24
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19970626	930	50
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19970820	915	125
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19971112	915	28
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19971217	915	32
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19980225	930	559
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19980429	930	41
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19980624	930	56
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19980819	930	18
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19981216	900	358
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19990324	1000	37
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19990428	930	62
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19990526	930	26
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19990630	930	19
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19990825	930	13
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	20000126	1015	9

IID Water Balance Data

Description	Recorded	Calibration	Capped Baseline	200 kaf on-farm plus 100 kaf system		300 kaf DW	
				230 kaf on-farm	130 kaf on-farm		
Imported Colorado River Water ¹	2,866,000	2,857,000	2,803,000	2,495,000	2,566,000	2,668,000	2,490,000
Canal and Reservoir Evaporation	-	21,000	19,000	17,000	17,000	18,000	17,000
Canal seepage	-	123,000	111,000	89,000	104,000	107,000	100,000
Main canal spills	-	7,000	-	-	-	-	-
Lateral spills	-	117,000	99,000	15,000	99,000	99,000	99,000
Sum of Delivery System Losses ²	272,000	268,000	229,000	121,000	220,000	224,000	216,000
Delivery to Farms	2,490,000	2,490,000	2,458,000	2,258,000	2,229,000	2,328,000	2,158,000
Crop Eta	-	1,807,000	1,807,000	1,806,000	1,806,000	1,806,000	1,593,000
Other Evaporation	-	-	-	-	-	-	-
Effective Rainfall	-	101,000	101,000	101,000	101,000	101,000	101,000
Tailwater	-	390,000	344,000	197,000	178,000	252,000	305,000
Tilewater	-	394,000	408,000	356,000	346,000	371,000	361,000
Delivery to M&I + Stock + Misc ³	105,000	105,000	120,000	120,000	120,000	120,000	120,000
Consumptive Use from M&I + Stock + Misc	-	76,000	86,000	86,000	86,000	86,000	86,000
Return Flow from M&I + Stock + Misc	-	29,000	34,000	34,000	34,000	34,000	34,000
Change in Soil Water and Groundwater Storage	-	-	-	-	-	-	-
Recovered return flow from Mesa Lateral 5	-	4,000	4,000	4,000	3,000	4,000	4,000
Rainfall Runoff and Deep Perc	-	34,000	38,000	36,000	37,000	37,000	38,000
Evaporation and Phreatophyte Use	-	125,000	125,000	125,000	125,000	125,000	125,000
Mesa Storm Inflows	-	8,000	8,000	8,000	8,000	8,000	8,000
Subsurface Inflow (Estimated)	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Alamo River from Mexico	2,000	2,000	2,000	2,000	2,000	2,000	2,000
New River from Mexico	165,000	165,000	165,000	165,000	165,000	165,000	165,000
Alamo River to the Salton Sea	604,000	605,000	576,000	401,000	448,000	503,000	517,000
New River to the Salton Sea	454,000	453,000	431,000	335,000	346,000	382,000	399,000
Direct to Sea	100,000	101,000	92,000	56,000	70,000	80,000	86,000
Subsurface to Sea (Estimated)	1,000	1,000	1,000	1,000	1,000	1,000	1,000

Notes:

- 1) AAC at Mesa Lateral 5 by water balance from recapitulation data.
- 2) Sum of delivery system losses is calculated from the difference in recorded diversions less deliveries.
- 3) Includes estimates of deliveries to rural pipes and community greens.

Not Rounded

				200 kaf on-farm plus 100 kaf	300 kaf DW	
	Recorded	Calibration	Capped Baseline	system 230 kaf on-farm	130 kaf on-farm	fallowing
Seepage+evap	2,865,680	2,856,960	2,802,992	2,494,696	2,565,842	2,668,274
		143,574	130,115	105,921	121,271	124,994
		20,849	18,857	17,109	17,406	18,033
		122,725	111,258	88,812	103,865	106,961
		6,741	-	-	-	-
		116,936	98,980	14,668	99,128	99,333
Total deliveries	271,531	267,251	229,095	120,589	220,399	224,327
			2,578,130	2,378,043	2,348,778	2,448,071
		2,489,718	2,458,130	2,258,043	2,228,778	2,328,071
Crop Eta should be constant across runs	2,489,615	1,806,283	1,806,553	1,805,718	1,805,526	1,806,019
						1,592,414
		100,680	100,680	100,680	100,680	100,680
		389,951	344,230	197,358	178,085	251,882
		394,165	408,028	355,647	345,847	370,849
						361,440
	104,534	104,534	120,000	120,000	120,000	120,000
		76,262	86,010	86,010	86,010	86,010
		28,272	33,990	33,990	33,990	33,990
		4,436	4,233	3,936	3,335	4,124
Rainfall RO&DP should be constant across runs	36,723	39,556	38,274	38,079	38,697	39,102
	125,141	125,141	125,141	125,141	125,141	125,141
	7,856	7,856	7,856	7,856	7,856	7,856
	20,000	20,000	20,000	20,000	20,000	20,000
	1,712	1,712	1,712	1,712	1,712	1,712
	164,744	164,744	164,744	164,744	164,744	164,744
	604,479	605,088	576,320	401,417	447,842	503,361
	453,504	452,980	431,398	335,330	346,222	382,026
	100,195	101,182	92,262	56,238	69,766	80,373
	1,000	1,000	1,000	1,000	1,000	1,000